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PUBLIC WORKS
DEPARTMENT

October 9, 2009

Mr. Jason Shirey
Water Pollution Biologist
PA Department of Environmental Protection
Southcentral Regional Office
909 Elmerton Avenue
Harrisburg, PA 17110

Re: Angelica Creek Park Restoration Project (PA DEP E06-610)
Spring 2009 Monitoring Report

Dear Mr. Shirey:

Enclosed you will find two copies of the Spring 2009 Angelica Creek Park Restoration Project Monitoring Report completed by A. D. Marble and Company. This report discusses the monitoring during the 2nd year of spring monitoring. As required, monitoring will occur in the fall 2009 prior to being reduced to annual monitoring for 2010 to 2012.

Please contact me at 610-655-6258 if you have any questions or contact Xavier Riva at A. D. Marble at 484-533-2568 with any technical questions or comments.

Sincerely,

A handwritten signature in dark ink, appearing to read "Deborah A.S. Hoag".

Deborah A.S. Hoag, P.E.
Utilities Division Manager

DH/eh

Cc: Charles M. Jones, P.E., Director of Public Works
Christopher A. Day, US EPA
file



ANGELICA CREEK PARK RESTORATION PROJECT

Monitoring Report: Results of Spring 2009 Monitoring Event

Angelica Creek Park, Reading, Berks County, Pennsylvania

Prepared for:

Public Works Department
City of Reading
503 North Sixth Street
Reading, Pennsylvania 19601

Prepared by:

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July 2009

ABSTRACT

This report details the results of the spring monitoring of the second year of wetland and waterway monitoring of the Angelica Creek Park restoration project located in Reading, Berks County, Pennsylvania. Angelica Creek is a tributary to the Schuylkill River within the Upper Schuylkill River Basin. The project was created as a Supplemental Environmental Project (SEP) for the U.S. Environmental Protection Agency (USEPA) in order to mitigate for unauthorized discharges associated with the city's sewage treatment plant (USEPA Permit USAO# 2003V00437). As part of the USEPA-mandated consent decree with Reading and as reflected in the Pennsylvania Department of Environmental Protection (PADEP) permit (PADEP E06-610), the site will be monitored for five years: twice in the first two years and once each year thereafter. Monitoring of the Angelica Creek Park restoration project in 2009 was completed during site observations made in April, May, and June 2009. Reading's Public Works Department will continue to maintain the site during and after the five-year monitoring period.

The project's purpose is to create an environmental education park that is open to the public and that would stabilize and restore Angelica Creek, filter and store stormflow, create a range of naturalized habitats for aquatic and terrestrial wildlife, reestablish this reach of the creek as a cold water fishery (CWF), and provide access for recreation and observation of wildlife. In order to fulfill the project's purpose, A.D. Marble & Company provided a conceptual design that was adopted by the EPA as part of the SEP and incorporated into the their goals for the Angelica Creek park. The goals were as follows:

- 1) Restore approximately 2,000 linear feet of Angelica Creek.
- 2) Restore aquatic habitat, restore and stabilize the streambanks using bioengineering techniques (i.e., rock and log vanes, root wads), and restore floodplain habitat.
- 3) Develop a 100-foot riparian buffer from the pedestrian bridge to the S.R. 0010 underpass.
- 4) Construct two wetland areas of approximately one acre each.
- 5) Construct a 0.5-acre pond (open water habitat).
- 6) Develop three acres of upland meadow habitat around the wetland and riverine areas.

The site will be monitored for a total of five years post-construction. This report is intended to provide a study of existing conditions following the beginning of the second growing season after construction.

As of the first year of monitoring (Spring and Fall 2008), this site had developed approximately 1.5 acres of vegetated emergent wetland, 0.6 acre of submerged/deep open water habitat, and 14.3 acres of meadow and riparian habitat. As of spring of the second year of monitoring, the acres of vegetated emergent wetland were estimated to be 1.4 acres, a slight decrease from 2008 levels. The site maintained 0.6 acres of submerged/deep open water habitat and approximately 14.4 acres of meadow and riparian habitat.

As of spring 2009, the streambanks within the park area are stable, and rock and log vanes, as well as the root wads, are installed and appear to function as designed. In addition, the site contains a dense herbaceous cover throughout the park and 98 percent of the 100 planted trees have survived overall, although the number of stressed individuals has increased from 2008 to 2009. The site is used as habitat by deer, small mammals, birds, and amphibians. The stream appears to be sustaining a macroinvertebrate population that is fairly diverse and fairly tolerant of pollution, which is typical of small streams in developed areas. Overall, the site meets the

design and planned goals adopted by the EPA's SEP program to restore and enhance the park habitat while providing a variety of critical habitat. Future monitoring events will continue to evaluate the stream and wetland areas as well as document the success of planted species and the spread of invasive species.

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I. INTRODUCTION

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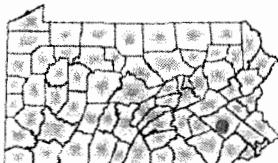
The city of Reading, located in Berks County, Pennsylvania (Figure 1), completed the construction of a 12-acre environmental educational park in the former location of Angelica Lake in fall 2007. This project was designed and constructed to restore the stream channel and floodplain and create wetlands within the former lakebed in order to develop unique ecological functions and values associated with the tributary to the Schuylkill River. In addition, pedestrian trails and crossings were created to encourage active and passive recreational opportunities for the local community.

A. Site and Project History

Before the Industrial Revolution, Angelica Creek flowed unimpeded through the mostly rural project setting. However, in the late 1800s, the Angelica Ice Company constructed an earthen dam along the creek to create Angelica Lake and facilitate ice production. In 1915, the city of Reading purchased the lake for public recreation, which included boating, fishing, and swimming. The city of Reading managed the lake for recreation until 2001 when Tropical Storm Alison dropped approximately 8 inches of rain in 24 hours, causing a dam breach and failure that drained the entire lake and damaged the S.R. 0010 bridge adjacent to the dam. The bridge was restored, but the dam was never reconstructed and the creek again flowed unimpeded into the Schuylkill River. Over time, Angelica Creek reestablished a meandering stream channel through the lake sediments, but the stream channel and floodplain remained in a degraded state due to poor bank stabilization, low habitat quality, and especially high sediment yields during storm events.

Reading's Public Works Department proposed to fund and construct a restoration project for this segment of Angelica Creek as part of a United States Environmental Protection Agency (USEPA)-mandated consent decree (USAO No. 2003V00437) (Appendix I). The project was part of a Supplemental Environmental Project (SEP) to mitigate for unauthorized discharges related to the city's sewer treatment plant. The restoration project would successfully stabilize the previously drained Angelica Lake basin in a way that would restore natural habitats and create public environmental educational and recreational opportunities.

Figure 1
Project Location Map
 Angelica Creek Restoration Project
 Reading, Pennsylvania



2,000 0 2,000
 Feet

Project Location

In order to fulfill the goals of the SEP, a conceptual design was solicited from A.D. Marble & Company for the park property. The conceptual design included 2,000 linear feet of stream restoration and stabilization, a 100-foot wide riparian buffer and floodplain zone, 0.5 acre of pond, two acres of palustrine emergent wetland, and three acres of upland meadow. In an effort to enhance the wildlife value of the park, the conceptual design also included wildlife habitat structures: bluebird boxes, wood duck boxes and perching structures, bat boxes, and in-stream structures for aquatic species. In addition, the site design provided for a walking trail, a new pedestrian bridge, a boardwalk through wetland habitat, and trail and educational signage.

Site construction and planting was completed in October 2007. The initial site monitoring was completed by A.D. Marble & Company in 2008. Subsequent monitoring and assessments for 2009 through 2012 will be completed by A.D. Marble & Company, with the potential for assistance from Albright College and Alvernia University faculty and students.

As designed, the site has five distinct vegetative communities: Wetland 1, Wetland 2, the pond, the riparian buffer, and the upland meadow. The five vegetative zones were planted and seeded with vegetation specific to the intended habitat. The plant stock and seed mixtures for each habitat are listed in Appendix C. A comprehensive list of all species identified within the project area, both planted/seeded and volunteer, is located in Appendix B. The plant sampling methodology is intended to record both planted and volunteer species present within the site. It should be noted that the pond was intended as an open water system and was planted only along the edge.

The five communities also rely on a variety of hydrologic inputs to maintain the intended biotic communities. Wetland 1 and Wetland 2 are both intended to receive event-related stormwater from the surrounding landscape and floodflow from the creek during significant storm events. Wetland 1 was designed to have multiple sources of hydrology, including stormwater runoff from the landscape, floodwater from Angelica Creek during significant flood events, and groundwater sources particularly closer to the pond. Approximately 100 feet downstream from the old pedestrian bridge, a diversion structure directs floodflow from the creek into the western end of the Wetland 1 basin. Subsurface and surface flow is intended to move from west to east

into the pond. The pond level is controlled by an outlet structure at the eastern end that discharges via a rock-lined swale into Angelica Creek, upstream from the new pedestrian bridge.

Wetland 2 also receives multiple sources of hydrology, including runoff from the adjacent hillside, seeps, and the occasional floodflow from Angelica Creek. Although Wetland 2 has no input structure, it discharges into Angelica Creek via a rock-lined swale downstream from the new pedestrian bridge.

The remaining vegetative zones within the project area are the riparian riverine zone and the upland meadow. The riparian riverine zone is intended to receive water from the creek during significant flood events. The upland meadow is intended to rely solely on direct precipitation. These habitats are present on both sides of Angelica Creek.

This report documents site conditions after the second year's spring monitoring event. Discussion of the current conditions and success of created natural habitat is based on the successful establishment of vegetation appropriate for wetlands, riparian buffers, and upland meadows, as well as the presence and composition of the aquatic habitat. Specific information includes observations of wildlife and in-stream structures, wetland descriptions, percent vegetative cover and vegetative diversity assessments, woody plant survivorship, photographs, and maps documenting current conditions. Also included is an assessment of invasive species, including areas of greatest prevalence and a discussion of eradication techniques.

II. METHODS

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The site design called for the establishment of five separate vegetative zones:

- Wetland 1 (south of Angelica Creek)
- Wetland 2 (north of Angelica Creek)
- Pond (downgradient of Wetland 1)
- Upland Meadow (both sides of the waterway)
- Riparian buffer and floodplain (both sides of the waterway)

Field visits for the spring monitoring occurred on April 24, 2009, May 18, 2009, and June 9, 2009. In April 2009, initial photographs and general site observations were made. In May 2009, additional wildlife observations and photographs were made, the wetland line was delineated, and tree survivorship, herbaceous cover, and diversity were assessed. Additional site photographs and invasive species observations were taken on June 9, 2009.

A. Establishment of Sampling Location

A linear sampling transect for each of the wetland habitats was established in 2008 based on the proposed wetland boundary and existing basins. Transect A passes through Wetland 1. Transect B passes through Wetland 2. Transect B also includes portions of the riparian zone and upland meadow. One-inch diameter PVC posts were placed at approximately 300-foot intervals to minimize site disturbance. No posts were placed in the pond. Future site sampling methods may allow for sampling within the pond. Sample plots were located at 100-foot intervals along each transect. Five sample plots were established along Transect A in Wetland 1. Nine sample plots were established along Transect B. See Appendix G, Plan Sheet 1 for the location of each sampling plot and transect.

At each sample plot location, a one-square-meter (10.8-sq. ft) sampling frame, or quadrat, was placed over the sample plot stake and to the right of the transect. The sampling quadrat, measuring two by 0.5 meter (6.6 by 1.6 ft), was oriented parallel to the baseline, with the stake touching the upper left corner of the frame. This ensured consistent sampling of the vegetation within the site each year.

B. Vegetation Sampling

1. Herbaceous Cover. When sampling vegetation within a given quadrat, each sampling plot will include a range of vegetative species with varying hydrological tolerances. The number of hydrophytic species versus non-hydrophytic species within a quadrat has a direct correlation to the level of hydrology available in and around that quadrat and to the development of wetland conditions at the site.

Herbaceous vegetation generally includes all vascular plants and woody plants under 24 inches in height. Both planted and volunteer herbaceous vegetation were sampled using visual estimates of percent aerial coverage within one-square-meter (10.8-sq. ft) quadrats. The dominant plant species were identified based on canopy coverage within each plot. Any plant species with less than five percent coverage was recorded as trace. Where applicable, estimated percents of standing water and bare earth were also recorded. Data for each quadrat are located in Appendix A. Although the project does not require a set permitted percent cover, a high percent of vegetative cover is beneficial to soil retention and stability.

To determine whether the vegetation sampled within each quadrat was hydrophytic, the Wentworth Index, based on a plant's indicator status, was used to obtain a weighted value for all plant species identified in the quadrat (Wentworth et al. 1988). The indicator value of each plant species was based on the wetland indicator status of plants from the *National List of Plant Species that Occur in Wetlands, Region 1 - Northeast* (Sabine 1993). The indicator values for the plants range from wettest (OBL = 1.0) to driest (UPL = 5.0). In this way, a Wentworth value corresponds to the types of species present within a quadrat and their percent cover within that quadrat. Quadrats located in an area that is successfully developing wetland characteristics would be expected to have a Wentworth Value between 1.0 and 3.0. Quadrats located in an area that is developing upland characteristics would be expected to have a Wentworth Value greater than or equal to 3.0.

The weighted value for the plants was obtained by multiplying the percent cover of the plant species within the plot by the plant's indicator value and dividing by the total percent vegetative

cover of the plot. By totaling the weighted values of each plant species, the Wentworth Index was determined. Any quadrat with a total indicator value less than or equal to 3.0 is considered to contain a dominance of hydrophytic vegetation. Any plant listed as NI (No Indicator) was automatically assigned an indicator value of 5.00. Open water, bare earth, and any plant species with trace cover or that could not be identified to the species level were not included in the weighted value calculation.

Mean percent cover was then calculated for all the quadrats sampled within the constructed mitigation site. This was done by adding the visually estimated percent aerial coverage for each of the quadrats and dividing by the total number of quadrats sampled. Relative percent cover was then calculated and documented for the dominant species recorded. This value is a measure of the relative abundance of each of the dominant species within the mitigation site and allows for species composition changes to be tracked on the site for the duration of the monitoring period.

In addition to quadrat sampling, composite lists of herbaceous vegetation were compiled for each distinct habitat (Wetland 1, Wetland 2, Riparian/Floodplain, Upland Meadow, and Pond). These lists include both planted and volunteer species and are included in Appendix B.

2. Survivorship of Woody Plants. According to the original landscape plans, nine species of trees and 13 species of shrubs were planted within the proposed meadow, riparian, and wetland zones. Five species of aquatic plants were planted within Wetlands 1 and 2, as well as along the pond border. Shrubs were not tagged. Visual observations of planted trees and shrubs were made in May 2008.

Ninety-seven trees were tagged to determine survivorship of the woody plant species on both an annual basis and over the five-year-monitoring period. A few trees were not planted in the exact locations indicated on the plan sheets. Subsequent tagging during the August 2008 monitoring resulted in a total of 100 trees being tagged and assessed.

During the May 2009 monitoring, the condition of each tagged plant was noted and described as alive, stressed, dead, or missing. If tags were missing during the May field view, assumptions as

to number were made based on nearby tagged specimens. Clusters of untagged shrubs were also noted and described accordingly.

Alive – Plant has a healthy amount of foliage, fruiting structures, and buds.

Stressed – Plant has discolored foliage or lacks foliage and fruiting structures.

Dead – No foliage or fruiting structures apparent on the entire plant; twig tips break off.

A listing and count of species tagged as well as a summary of the survivorship are included in the results section (Section III) of this report. A complete individual listing and health assessment of all tagged trees is located in Appendix D.

C. Wetland Delineation

A wetland delineation was performed in May 2009 using modified criteria based on the procedures outlined in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). The wetland delineation was based primarily on the presence of hydrophytic vegetation and hydrology as hydric soils have not fully developed. The wetland limits were mapped using a Trimble GPS unit.

D. Stream Monitoring

The aquatic biotic community was sampled in 2008. The stability of the streambanks and the condition of the bioengineering measures were monitored during each of the spring 2009 field views. During the site visit, photographs were taken and a visual survey was performed to determine if erosion or instability of the streambanks has occurred. In addition, the condition of in-stream structures, such as rock and log vanes and root wads, were observed to determine if these features remained intact and whether the desired aquatic habitat (i.e., pools, riffles) was created. Photographs of each vane were taken, as well as of the entire stream corridor, and will serve to evaluate their effectiveness in subsequent years. These photographs are located in Appendix E (Photographs 6 to 11) and Appendix F (Photographs D through F).

E. Photograph Stations

Eleven photograph locations were chosen to document conditions throughout the five-year-monitoring process. Photographs at each location taken during the 2009 monitoring season are included in Appendix E. The locations and directions of these photograph stations are shown on Plan Sheet 1 in Appendix G. Additional representative photographs of the entire site have been provided in Appendix F to show existing on-site conditions over the second growing season.

III. RESULTS

III. RESULTS

The basins of Wetland 1 and Wetland 2 were designed to be wetland habitat. Riparian areas were to be located on both floodplains of Angelica Creek. The remaining lands were designed to be meadow habitat. The results of the spring 2009 delineation indicate that 1.4 acres of palustrine emergent wetland and 0.6 acre of submerged/open water habitat are present at the site. As of May 2009, Wetland 1 has maintained approximately 0.29 acre of palustrine emergent wetland habitat, 0.07 acre (0.03 hectare) less than in 2008. Wetland 2 has maintained the 1.1 acres of palustrine emergent wetland habitat previously delineated in 2008. These areas are shown in Appendix G, Plan Sheet 2.

A. Establishment of Vegetative Habitats

1. Wetland Habitat – Wetland 1 and Wetland 2. Transect A starts at the edge of the Wetland 1 basin and ends at the upland boundary between the open water area and the trail parallel to Angelica Creek. Three of the four Transect A plots are within Wetland 1. A section of the transect fell within the open water pond; no plots were able to be placed within the pond. Transect B starts at the meadow, slopes upland along S.R. 0010, and extends across Wetland 2 to the riparian riverine zone and the upland meadow. Four of the eight Transect B plots are within Wetland 2.

Table 1 shows the Wentworth Indicators for the eight plots associated with Wetland 1 and Wetland 2 for the first monitoring event. Seven of the eight plots had a dominance of wetland vegetation, as indicated by a Wentworth Index value less than 3.0. Six of the eight plots had a lower indicator value than in August 2008. This is primarily due to the presence of bare ground or open water within a quadrat in May 2009, rather than a significant change in the type of vegetation. A detailed list of recorded vegetation and indicators in each quadrat is located in Appendix A. Composite vegetation lists for each wetland are located in Appendix B.

Table 1. Quadrats and Indicator Values in Designed Wetland Habitat, 2008-2009.

Quadrat	Designed Habitat	Weighted Wentworth Indicator Value	
		August 2008	May 2009
A+000	Wetland 1	2.17	2.00
A+100	Wetland 1	2.95	2.74
A+200	Wetland 1	3.32	3.23
A+300	Wetland 1	1.97	2.42
B+100	Wetland 2	2.15	1.67
B+200	Wetland 2	1.80	1.61
B+300	Wetland 2	1.45	1.60
B+400	Wetland 2	3.43	2.37

Both the vegetation within the quadrats and composite lists of vegetation within Wetlands 1 and 2 indicate that planted and seeded species, as well as volunteer species from the surrounding landscape, are growing within the basin. Of the 42 herbaceous plant species identified within Wetland 1 in 2009, 25 are volunteer species. Five of these are known to be invasive: *Humulus japonicus* (Japanese hops), *Lythrum salicaria* (purple loosestrife), *Phalaris arundinacea* (reed canary grass), *Robinia pseudoacacia* (black locust), and *Persicaria perfoliata* (mile-a-minute or Asiatic tearthumb). Of the 34 species identified within Wetland 2 in spring 2009, 17 are volunteer species. Six of these are known invasive species: Japanese hops, purple loosestrife, black locust, mile-a-minute, reed canary grass, and *Phragmites australis* (common reed). Of the six invasive species located within the wetland areas, purple loosestrife and mile-a-minute are listed as Pennsylvania Noxious Weeds.

Similar to 2008, in 2009 there are differences in the average Wentworth Indicator value between the two wetlands. Although the overall vegetative composition is similar between the basins, Wetland 1 had an average indicator value of 2.62, which is virtually the same as the fall 2008 average indicator value of 2.60. Wetland 2 had an average indicator value of 1.81, virtually the same as fall 2008 average indicator value of 1.80. The disparity between the two wetland areas can best be explained by the hydrological differences. Wetland 1 had no standing water with the exception of the adjacent pond, and upland vegetation was present and dominant in portions of the site. Wetland 2 had pockets of standing water throughout the wetland and was dominated entirely by hydrophytic vegetation.

The two wetlands also show differences in dominant species identified within the quadrats. Dominant species are those that comprise 20 percent cover or more of a given quadrat.

Wetland 1 had eight species that were dominant in at least one quadrat (Table 2); the indicator value of these species ranged from FACW+ (1.67) to FACU- (4.33). The only species dominant in more than one quadrat were facultative species (3.0). This may indicate that a significant section of Wetland 1, centered around section A+200, may not develop wetland characteristics without changes in hydrology.

Three volunteer species were dominant in Wetland 1 quadrats: two are facultative upland species and one is facultative wetland (Table 2). As previously noted, the hydrophyte is purple loosestrife, an invasive species and a Pennsylvania Noxious Weed. Purple loosestrife was also noted throughout the park. See Section III.C for additional information about invasive species within the project area.

Table 2. Dominant Vegetation in Wetland 1 Quadrats – Spring 2009.

Common Name	Scientific Name	Indicator Value	Location	Volunteer Species? (Yes/No)
blue vervain	<i>Verbena hastata</i>	FACW+	A+300	No
fowl bluegrass	<i>Poa palustris</i>	FACW	A+100, A+200	No
Kentucky bluegrass	<i>Poa pratensis</i>	FACU	A+200	No
orchard grass	<i>Dactylis glomerata</i>	FACU	A+100	Yes
purple loosestrife	<i>Lythrum salicaria</i>	FACW+	A+300	Yes*
red clover	<i>Trifolium pratense</i>	FACU-	A+200	Yes
slender rush	<i>Juncus tenuis</i>	FAC-	A+300	No
soft rush	<i>Juncus effusus</i>	FACW+	A+000	No

* Volunteer and Invasive Species

In spring 2009, Wetland 2 had only three dominant species. This does not necessarily correlate to a lack of overall diversity at the site but indicates the early point in the growing season and the amount of dead vegetation from 2008 present in many of the quadrats. For example, at Quadrat B+200, due to the presence of dead vegetation, only one living species was identified. Of the three dominant species identified, two species were dominant in more than one quadrat; the indicator value of these species ranged from OBL (1.0) to FACW+ (1.67) (Table 3). Two of these, purple loosestrife and reed canary grass, are volunteer species but are also considered invasive species. See Section III.D for additional information about invasive species within the project area.

Table 3. Dominant Vegetation in Wetland 2 Quadrats – Spring 2009.

Common Name	Scientific Name	Indicator Value	Location	Volunteer Species? (Yes/No)
dark green bulrush	<i>Scirpus atrovirens</i>	OBL	B+200	No
purple loosestrife	<i>Lythrum salicaria</i>	FACW+	B+100, B+400	Yes*
reed canarygrass	<i>Phalaris arundinacea</i>	FACW+	B+200, B+300, B+400	Yes*

* Volunteer and Invasive Species

2. Riparian Riverine Zone. The riparian riverine zone extends parallel to the streambanks of Angelica Creek and is intended to be an active floodplain with a mix of hydrophytic and upland vegetation. A significant number of planted woody vegetation (trees and shrubs) are located in this zone. Two of the quadrats along Transect B are located in the riparian zone.

Table 4 lists the Wentworth Indicators for these plots in spring 2009. Riverine areas were planted with a mix of hydrophytic and upland vegetation and, therefore, cannot be distinguished by their indicator value. However, the riverine area is intended to be part of the Angelica Creek floodplain and, as such, should be inundated fairly frequently during storm events. For this reason, it is likely that a functioning riparian zone would be closer to the middle of the indicator value range, with neither obligate species (1.0) or upland species (5.0) as dominant within a given quadrant.

The significant drop in the indicator value for Quadrat B+500 from 2008 to May 2009 is not likely due to a change in hydrology but rather to the dominance of facultative-wetland species in early spring and lack of diversity caused by the early growing season. A detailed list of observed vegetation and indicators in each quadrat is located in Appendix A; a composite vegetation list for the riparian riverine zone is located in Appendix B.

Table 4. Quadrats and Indicator Values in Designed Riparian Habitat, 2008-2009.

Quadrat	Designed Habitat	Weighted Wentworth Indicator Value	
		Fall 2008	Spring 2009
B+500	Riverine	3.20	2.31
B+600	Riverine	1.89	1.92

In the riparian quadrats, three species were dominant, all of which were volunteer species. Two of these species, purple loosestrife and reed canary grass, are considered to be invasive species. As noted previously, purple loosestrife is also a Noxious Weed of Pennsylvania. In addition, Canada thistle (*Cirsium arvense*) is present in the riparian zones, which is also listed as a Noxious Weed of Pennsylvania. See Section III.C and the Maintenance Plan for information on eradicating invasive species.

Table 5. Dominant Vegetation in the Riparian Zone – Spring 2009.

Common Name	Scientific Name	Indicator Value	Location	Volunteer Species? (Yes/No)
jewelweed	<i>Impatiens capensis</i>	FACW+	B+600	Yes
purple loosestrife	<i>Lythrum salicaria</i>	FACW+	B+600	Yes*
reed canarygrass	<i>Phalaris arundinacea</i>	FACW+	B+500	Yes*

* Volunteer and Invasive Species

3. Upland Meadow. The meadow areas are located along the slopes of Angelica Creek, as well as between the wetland and the hillside in the northern and northwestern portions of the site. The meadow is intended to provide habitat and cover for many avian and insect species using the site and includes wildflower mixes and planted deciduous trees. One quadrat along Transect A and three quadrats along Transect B are located in the meadow zone. A detailed list of recorded vegetation and indicators in each quadrat is located in Appendix A; a composite vegetation list for the meadow zone is located in Appendix B.

Table 6 shows the Wentworth Indicators for these plots in 2009. Three of the four meadow plots have a Wentworth Index value of greater than 3.0. Quadrat B+700 has an indicator value of less than 3.0, but this is likely due to the presence of a plant that could not be identified due to the early growing season as well as the presence of purple loosestrife and reed canary grass within the quadrat. It is anticipated that an increase in plant development and diversity will show this quadrat to be dominated by upland vegetation during subsequent monitoring events.

Table 6. Quadrats and Indicator Values in Designed Meadow Habitat, 2008-2009.

Quadrat	Designed Habitat	Weighted Wentworth Indicator Value	
		Fall 2008	Spring 2009
A+END	Meadow	3.52	4.28
B+000	Meadow	3.60	4.68
B+700	Meadow	3.67	2.74
B+800	Meadow	3.10	4.13

In the meadow areas, seven species were dominant; three (Fuller's teasel, an unidentified goldenrod, and oxeye daisy) were dominant in multiple quadrats (Table 7). One of the dominant species was seeded, and two are considered to be invasive species. In addition, Canada thistle (*Cirsium arvense*) is present in the meadow zones, which is also listed as a Noxious Weed of Pennsylvania. See Section III.C and the Maintenance Plan for information on eradicating invasive species.

Table 7. Dominant Vegetation in Upland Meadow - Spring 2009.

Common Name	Scientific Name	Indicator Value	Location	Volunteer Species? (Yes/No)
annual ragweed	<i>Ambrosia artemisiifolia</i>	FACU	B+800	Yes
Fuller's teasel	<i>Dipsacus fullonum</i>	NI	A+END, B+000	Yes
goldenrod sp.	<i>Solidago sp.</i>	-	B+700, B+800	Yes
Kentucky bluegrass	<i>Poa pratensis</i>	FACU	A+END	Yes
oxeye daisy	<i>Leucanthemum vulgare/Crysanthemum leucanthemum</i>	UPL	B+000, B+700	No
purple loosestrife	<i>Lythrum salicaria</i>	FACW+	B+700	Yes*
reed canarygrass	<i>Phalaris arundinacea</i>	FACW+	B+700	Yes*

* Volunteer and Invasive Species

B. Woody Vegetation

Survivorship of the tagged woody plants was evaluated in May 2009 to determine the percent survivorship in the beginning of the second growing season (Appendix D). To evaluate woody survivorship at the site, every planted tree that was shown in the planting plan, as modified in 2008, was recorded in May 2009. The planting plan was modified in 2008 to reflect additional trees planted to replace dead individuals, as well as to show the accurate location of each tree. The woody vegetation was observed to have a 98 percent survival rate (alive and stressed) of planted individuals in the beginning of the second growing season.

Of the 100 trees tagged, 13 were observed to have signs of stress including dieback along the top and sides and bark damage. Table 8 summarizes the survivorship of planted trees at the site, by species and health level.

Table 8. Planted Tree Survivorship by Species, Spring 2009.

<i>Scientific Name</i>	Common Name	Plan Sheet 3 Abbreviation	Number Planted at Site	2009 Tree Survey			
				Alive and Thriving (A)	Alive and Stressed (S)	Dead (D)	Missing (M)
<i>Acer saccharinum</i>	silver maple	AS	13	12 (92%)	1 (8%)	0 (0%)	0 (0%)
<i>Betula nigra</i>	river birch	BN	20	19 (95%)	0 (0%)	0 (0%)	1 (5%)
<i>Carpinus caroliniana</i>	ironwood	CC	8	5 (63%)	3 (37%)	0 (0%)	0 (0%)
<i>Fraxinus pennsylvanica</i>	green ash	FP	2	2 (100%)	0 (0%)	0 (0%)	0 (0%)
<i>Liriodendron tulipifera</i>	tulip poplar	LT	3	3 (100%)	0 (0%)	0 (0%)	0 (0%)
<i>Platanus occidentalis</i>	American sycamore	PO	10	9 (90%)	1 (10%)	0 (0%)	0 (0%)
<i>Pinus strobus</i>	white pine	PS	16	14 (88%)	1 (6%)	0 (0%)	1 (6%)
<i>Quercus palustris</i>	pin oak	QP	2	1 (50%)	1 (50%)	0 (0%)	0 (0%)
<i>Quercus rubra</i>	red oak	QR	26	18 (69%)	7 (27%)	0 (0%)	1 (4%)
TOTAL PLANTED TREES			100	85 (85%)	13 (13%)	0 (0%)	2 (2%)

Shrub clusters observed along the riparian riverine zone were overall in very good health. Two *Cornus racemosa* (red-osier dogwood) clusters located on the southern banks of the creek and near the new pedestrian bridge appear to be recovering from previous mechanical damage and gravel and debris wash, although the vegetation was not robust in May 2009. Additional observations of this area will be made in the fall 2009. Overall, the planted individuals, both shrubs and trees, appear to be healthy and thriving. One invasive woody species, black locust, is present throughout the site but is being addressed by the current management plan as implemented by the City of Reading. As of May 2009, most of the black locust trees have been cut and new root shoots or growth have not been observed.

A complete individual listing of tagged woody plants and survivorship results is located in Appendix D.

C. Invasive Species

In 2009, seven invasive species were identified within the Angelica Creek Park site. Invasive species can be native or non-native and tend to out-compete other vegetation for space and nutrients or strangle or stunt existing vegetation. Invasive species also can limit access and aesthetic enjoyment of the park. As agreed upon by the city of Reading, the Reading Public Works Department, Utilities Division's Wastewater Team, will be the primary agency maintaining the grounds and eliminating invasive vegetation. A maintenance plan has been developed by A.D. Marble & Company to deal with existing on-site invasive species. Implementation of this plan began in spring 2009.

Table 9 lists invasive species, status, and general location within the Angelica Creek project area in May 2009. A noxious weed is a plant species that has been determined to be a major pest of agricultural ecosystems and is subject, by law, to certain restrictions on a state or federal level (Plant Conservation Alliance-Alien Plant Working Group 2008). This means that it is illegal to grow, sell, or transport a species within a given state or throughout the country. Listing as an invasive species (I) indicates that while the species is not native and has the potential to do harm, the growth, sale, and distribution of the species is not illegal. However, the propagation of these species is not to be encouraged. Of the seven species identified in May 2009, one species, *Cirsium arvense* (Canada thistle), was not previously identified during the 2008 monitoring.

Table 9. Invasive Species Status - Spring 2009.

Common Name	Scientific Name	Weed Status (PANW, I)*	Present in Composite List(s)? (Y/N)	Present in Quadrat(s)? (Y/N)
Japanese hops	<i>Humulus japonicus</i>	I	Y	N
purple loosestrife	<i>Lythrum salicaria</i>	PANW	Y	Y
mile-a-minute / Asiatic tearthumb	<i>Persicaria perfoliatum</i>	PANW	Y	N
Canada thistle	<i>Cirsium arvense</i>	PANW	Y	N
reed canary grass	<i>Phalaris arundinacea</i>	I	Y	Y
common reed	<i>Phragmites australis</i>	I	Y	N
black locust	<i>Robinia pseudoacacia</i>	I	Y	Y

Source: Plant Conservation Alliance-Alien Plant Working Group, 2008.

*PANW - Pennsylvania State-Listed Noxious Weed; I - Invasive or weedy species according to Uva, R.H., J.C. Neal, & J.M. DiTomaso. Weeds of the Northeast. Cornell University Press, Ithaca, New York, as noted in the USDA Plants Database,

D. Local Fauna

In March 2008, five bluebird boxes, three wood duck boxes, and two bat boxes were installed at the site in appropriate onsite habitats to support various local fauna. The boxes were inspected in April and May 2009 to determine whether the boxes were being used and, if so, by which species. Table 10 lists the findings based on field observations.

Table 10. Occupancy of Bat, Bluebird, and Wood Duck Boxes, Spring 2009.

Box Type	Identification	Species & Date Observed
Bat	B1	N/A
Bat	B2	N/A
Bluebird	BB1	swallows: May 2009
Bluebird	BB2	swallows: April 2008
Bluebird	BB3	swallows: April 2008
Bluebird	BB4	swallows: April 2008
Bluebird	BB5	swallows: April 2008
Wood Duck	WD1	starlings: April 2008.
Wood Duck	WD2	starlings: April 2008.
Wood Duck	WD3	starlings: April 2008.

Other signs or direct observations of birds, mammals, and amphibians were noted at the site. In the wetlands and pond areas, bullfrogs were heard and tadpoles were observed. Small fish were observed in Angelica Creek, along with crayfish. No bluebirds were observed nesting in the boxes during the April or May field views, although bluebirds were observed in the vicinity in May 2009. Also observed were swallows, which nested in the bluebird boxes; swifts; crows; red-winged blackbirds; mourning doves; starlings; red-tailed hawks; turkey vultures; and one green heron. Deer browse, scat, and bedding areas were noted throughout the site. A vole was observed in the meadow, as well as multiple holes that are likely dug and used by groundhogs. A dead rattlesnake was observed, indicating the presence of secondary predators at the site.

The presence of predators, prey, and scavengers observed at the site indicates that the habitat is diverse enough to support a range of species. As the site develops, more native fauna will likely use Angelica Creek for its food, shelter, and breeding resources.

E. Determination of Wetland Boundaries

A wetland delineation was performed in May 2009 using modified criteria based on the procedures outlined in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). Since the site was recently built, hydric soils have not fully

developed. However, areas of the site are clearly functioning as wetlands. Therefore, the wetland delineation was based primarily on the presence of hydrophytic vegetation and hydrology. Over time, it is likely that hydric soils will develop in some of the areas designed as wetland habitat.

The wetland limits were mapped using a Trimble GPS (Appendix G, Plan Sheet 2). In the areas designed as Wetland 1, approximately 0.29 acre of palustrine emergent wetland habitat was delineated in 2009. This excludes the pond, which was delineated as approximately 0.6 acre of palustrine open water/submerged habitat. As previously noted, the center of Wetland 1 does not support wetland habitat at this time but would be categorized as transitional area due to the mixture of upland and wetland species. Due to the lack of new growth and presence of dead vegetation, the center of the basin also does not support a dominance of hydrophytic vegetation.

In the area designated as Wetland 2 and the surrounding meadow and riparian sections, 1.1 acres of palustrine emergent wetland habitat were delineated. This is the same as in 2008. A section of the upland meadow area receives water from a stormwater swale allowing hydrophytic vegetation to dominate along the fringes of the swale. This area appears to be consistently saturated or inundated, based on the fall 2008 and spring 2009 monitoring events.

F. Stream Restoration Measures

Visual survey of the streambanks and bioengineering measures occurred during the majority of site visits. Photographs of the stream corridor and banks, as well as bioengineering measures, are located in Appendix E. A majority of the streambanks along Angelica Creek appeared stable and fully vegetated with herbaceous vegetation and shrubs. In addition, all rock and log vanes and root wads were intact and pools have developed downstream of these features.

One area of concern is the stream reach located between Rock Vane #3 and Rock Vane #4 (Appendix G: Plan Sheet 1), which shows signs of erosion and undercutting of the streambank. This area is covered by dense vegetation at the end of the growing season but was visible during the June 2009 field view (Appendix F, Photograph F). Without stabilization, the additional soil erosion could negatively affect the downstream streambed and associated biotic communities.

This area should be stabilized to prevent additional erosion and maintain the existing waterway channel.

IV. CONCLUSIONS AND RECOMMENDATIONS

IV. CONCLUSIONS AND RECOMMENDATIONS

The purpose of the Angelica Creek Park Restoration Project was to develop an environmental educational and recreational park through the restoration and enhancement of a degraded channel of Angelica Creek within the drained Angelica Lake basin. The project was intended to create a mix of wetland, open water, riparian floodplain, and upland meadow habitats along the 100-year floodplain. The site design also incorporated flood and stormwater control and sediment/nutrient filtration functions within the floodplain.

As noted previously, this project was developed as an SEP with the USEPA, in coordination with PADEP and United States Army Corps of Engineers (USACE). Both the USEPA and PADEP permits require a five-year annual monitoring and maintenance effort. The PADEP permit also requires biannual (every six months) monitoring of the site for the first two years, followed by annual monitoring for the remaining three years. In addition, woody vegetation that does not survive this time period is to be replaced. All permit documentation is in Appendix H.

A.D. Marble & Company delineated the site in 2009 to determine if the intended acreage of wetland, open pond, and riparian and upland meadow habitat had been created. The site was monitored to assess the development of vegetative cover, survivorship of woody plantings, presence of invasive species, wildlife usage, and the quality of restored stream habitat. The results of the 2009 spring monitoring indicate that the site overall remains successful in meeting its objectives.

Angelica Creek Park maintains a stable mix of wetland, meadow, open water, riparian, and riverine habitat. The designed wetland areas will continue to be monitored and corrective actions may be taken in Wetland 1 to increase palustrine habitat. Wetland 1 continues to function as a stormwater management facility for the site. Overall, the structures and streambanks of Angelica Creek remain stable. The site overall provides a range of habitats for birds and small mammals, and Angelica Creek supports fish. Vegetative diversity remains high and includes volunteer non-invasive species; planted woody vegetation overall is surviving. Invasive species are being monitored and will be controlled as part of the Maintenance Plan.

A. Design Elements of Angelica Creek Park Restoration Project

1. Designed Versus Delineated Palustrine Habitat. The total intended wetland acreage was approximately two acres; 1.3 acres were delineated in May 2009. Of the three designed palustrine habitats (Wetland 1, Wetland 2, and pond), the pond and Wetland 2 habitats are closer in acreage to their intended design. Wetland 2 was designed to be one acre in size; in May 2009, 1.1 acres were delineated, the same acreage as in 2008. Wetland 2 continues to exceed its intended boundaries due to the dominance of hydrophytic vegetation and wetland hydrology along the swales and along the riparian floodplain. The intended size of the pond was 0.5 acre; in May 2009, 0.6 acre was delineated, the same acreage as in 2008.

Wetland 1 has developed 0.29 acre of wetland, less than the designed goal of approximately one acre and slightly less than the area delineated in 2008 after the first growing season. Multiple reasons may be contributing to the slow rate of wetland development in the Wetland 1 basin. Initially it was thought that Wetland 1 may not be receiving the anticipated amount of storm flow from Angelica Creek through the diversion inlet structure. Preliminary field observations made by Dr. David Osgood of Albright College have indicated that storm water does enter the basin but infiltrates and drains rapidly. While the sediment basin behind the rock filter berm contains silt and remains saturated during most of the season, the area down-gradient contains cobble and does not retain surface hydrology for extended periods. Following storm events, surface water infiltrates rapidly and hydric conditions may not persist long enough to support a dominant hydrophytic cover. Therefore, the rapid drainage of stormwater from the basin is believed to be the primary factor in the lack of wetland vegetation. It is also likely that a low seasonal water table is insufficient to support wetland vegetation within the basin.

2. Stream Corridor and Bioengineering Measures. Along Angelica Creek, the stream restoration measures included regrading of the streambanks, stabilization with vegetation and coir bio-logs, and protection from streamflows with rock and log vanes, as well as root wads. The majority of the stream corridor remains fully vegetated and stabilized except for a small section below Rock Cross Vane #3 (Appendix F, Photograph F) noted earlier in this report. In this area, the coir bio-logs are no longer present and the bank has been undercut, leaving a

25-foot section of excised bank and a gravel bar that has developed on the opposite bank. This area has increased in length and severity from 2008 to spring 2009.

The visual observations of the rock and log vanes, as well as the snags, indicates that they are all functioning as designed. In particular, the snags provide habitat for macroinvertebrate that cling to woody debris and have created small pools that serve as resting and feeding areas for migrating fish. Several of the rock vanes have also created large pools in areas where silt deposits have been washed away to reveal deeper clay layers. In particular, the pools downstream of Rock Cross Vanes #4 and #6 are approximately 3 and 4 feet deep, respectively, and typically contain fish. It was, however, noted that several of the log vanes could have extended farther into the stream corridor to provide better bank protection and develop small pools.

3. Vegetative Cover and Diversity. The vegetative cover throughout the site varies throughout the site as of May 2009, not including maintained trails and clearings. The average percent vegetative cover measure within the quadrats in May 2009 is 82.9 percent, a significant drop from the fall 2008 average of 99.7 percent. This drop is attributed to the early stage of plant growth in spring 2009. A significant portion of the non-vegetated sampling area (17.4 percent) is bare ground and dead vegetation from the previous year. A small percentage of the sampling area (1 percent) was open water due to recent inundation. It is anticipated that after the 2009 growing season, the fall 2009 vegetation survey will show a much higher vegetated percent cover, comparable to the percent cover for fall 2008.

Overall, plant diversity throughout the site is high, which is beneficial for the maintenance of wildlife diversity. The herbaceous community throughout the site shows a mix of seeded/planted and volunteer species. Of the 69 species identified in the herbaceous layer, 22 species (32 percent) were volunteer species. Seven of these 22 species are considered invasive species, while three of the seven are listed as Pennsylvania Noxious Weeds. These invasive species will need to be actively managed as they can potentially out-compete desirable seeded and volunteer species and would decrease overall plant and wildlife diversity within the park. It is anticipated that additional species will be identified during the fall 2009 monitoring event.

The majority of planted trees and shrubs are alive and thriving at the site. However, 13 percent of tagged trees are stressed and two percent are missing. One *Betula nigra* (river birch) individual has been missing since 2008. One *Quercus rubra* (red oak) individual could not be located in May 2009.

4. Wildlife Usage. As of May 2009, the site is being used by species common to rural and suburban settings. Terrestrial insects, birds, amphibians, and mammals were observed during multiple site visits. The site was also designed to encourage the nesting of wood ducks, bluebirds, and bats. As of May 2009, no wood ducks or bats were observed at the site. Bluebirds were observed within the wetland and meadow habitats during the May 2009 site visit. However, they were not observed within the constructed nesting boxes. These species may visit or inhabit the site as beneficial conditions continue to develop.

B. Recommendations for Future Site Management

As noted in this report, the site appears to have stable stream bank, wetland, open water, floodplain, and meadow habitats after the first growing season. The site is used by local fauna, has been colonized by volunteer plant species, and is a popular site for passive and active recreation. The site has also been used by the Nolde Environmental Education Center, the North East Middle School, the Reading High School, and local college students for environmental workshops. The environmental educational component of this site will continue to develop over time with the construction of the environmental education center at the boathouse and the installation of interpretive signage.

The wetland areas provide the function of groundwater recharge/discharge, floodflow alteration (storage), production export, and wildlife habitat, as well as provide values associated with recreation, education, and visual quality (USACOE 1999). While Wetland 2 has successfully developed as designed (1.1 acre wetland vs. 1 acre intended), the majority of Wetland 1 contains a mix of facultative and upland species and would be classified as transition area. Wetland 1 has only developed pockets of wetland habitat (0.29 ac wetland); however, the wet spring and early summer may result in an increase of wetland area during the fall 2009 monitoring. New monitoring wells have been installed in Wetland 1 and will provide important clues as to the

seasonal high water table elevation and the rate of infiltration following flood events. This information will be used to make appropriate recommendations (ex: excavation of pools, altering diversion structure) to increase the development of wetland in this area.

A segment of Angelica Creek may require additional stabilization measures. An eroded bank section was noted between Rock Cross Vane #3 and the snag approximately 300 feet downstream. The eroded bank section is approximately 30 feet long. If this bank section continues to be undercut, remediation measures, such as rock armoring and slope regrading, may be recommended.

Finally, the presence of invasive species poses an ongoing concern for the overall health of the vegetative communities and wildlife diversity. Seven invasive species have been noted along the streambanks, wetlands, riverine, and meadow areas at the beginning of the second growing season following construction. Of these seven, purple loosestrife, Japanese hops, and Canada thistle were the most common in May 2009. The reduction and eventual eradication of these species using Best Management Practices should be a priority to maintain the vegetative diversity and overall habitat function of the site. Meetings with the city of Reading, Alvernia University, Albright College, Berks County Conservancy, and A.D. Marble & Company have taken place to address management of invasives during and following the five-year monitoring period. The site will continue to be maintained in accordance with the 2008 Maintenance Plan for Angelica Creek Park.

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APPENDIX A:
QUADRAT DATA AND
SUMMARY

Appendix A: Quadrat Data and Summary

Quadrat Data					
Site Name:		Angelica Creek Restoration Site		Investigators: SLJ/JG	
Quadrat ID:		A+000		Date: 5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
soft rush	Juncus effusus	55	FACW+	1.67	0.97
white clover	Trifolium repens	10	FACU-	4.33	0.46
fowl bluegrass	Poa palustris	10	FACW	2.00	0.21
purple loosestrife	Lythrum salicaria	10	FACW+	1.67	0.18
blue vervain	Verbena hastata	5	FACW+	1.67	0.09
jewelweed	Impatiens capensis	5	FACW	2.00	0.11
bare ground	-	5	-	-	-
	TOTAL:	100		Plot Indic.Val.	2.00

Quadrat Data					
Site Name:		Angelica Creek Restoration Site		Investigators: SLJ/JG	
Quadrat ID:		A+100		Date: 5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
orchard grass	Dactylis glomerata	30	FACU	4.00	1.33
fowl bluegrass	Poa palustris	20	FACW	2.00	0.44
tussock sedge	Carex stricta	15	OBL	1.00	0.17
purple loosestrife	Lythrum salicaria	10	FACW+	1.67	0.19
Fuller's teasel	Dipsacus fullonum	5	NI	5.00	0.28
blue vervain	Verbena hastata	5	FACW+	1.67	0.09
white clover	Trifolium repens	5	FACU-	4.33	0.24
bare ground	-	10	-	-	-
TOTAL:		100		Plot Indic.Val.	2.74

Quadrat Data

Site Name: Angelica Creek Restoration Site
Quadrat ID: A+200

Investigators: SLJ/JG
Date: 5/18/2009

HERBACEOUS VEGETATION:

Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
Kentucky bluegrass	<i>Poa pratensis</i>	25	FACU	4.00	1.00
fowl bluegrass	<i>Poa palustris</i>	25	FACW	2.00	0.50
red clover	<i>Trifolium pratense</i>	25	FACU-	4.33	1.08
common dandelion	<i>Taraxacum officinale</i>	10	FACU-	4.33	0.43
purple loosestrife	<i>Lythrum salicaria</i>	10	FACW+	1.67	0.17
tussock sedge	<i>Carex stricta</i>	5	OBL	1.00	0.05
TOTAL:		100		Plot Indic.Val.	3.23

Quadrat Data

Site Name: Angelica Creek Restoration Site
Quadrat ID: A+300

Investigators: SLJ/JG
Date: 5/18/2009

HERBACEOUS VEGETATION:

Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
blue vervain	<i>Verbena hastata</i>	40	FACW+	1.67	0.70
purple loosestrife	<i>Lythrum salicaria</i>	20	FACW+	1.67	0.35
slender rush	<i>Juncus tenuis</i>	20	FAC-	3.33	0.70
white clover	<i>Trifolium repens</i>	10	FACU-	4.33	0.46
annual ragweed	<i>Ambrosia artemisiifolia</i>	5	FACU	4.00	0.21
goldenrod sp.	<i>Solidago sp.</i>	5	-	-	-
reed canary grass	<i>Phalaris arundinacea</i>	T	FACW+	1.67	-
TOTAL:		100		Plot Indic.Val.	2.42

Quadrat Data					
Site Name:	Angelica Creek Restoration Site		Investigators:	SLJ/JG	
Quadrat ID:	A END		Date:	5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
Kentucky bluegrass	Poa pratensis	50	FACU	4.00	2.22
Fuller's teasel	Dipsacus fullonum	20	NI	5.00	1.11
white snakeroot	Ageratina altissima	10	FACU-	4.33	0.48
bare ground/ dead vegetation	-	10	-	-	-
annual ragweed	Ambrosia artemisiifolia	5	FACU	4.00	0.22
black locust	Robissinia pseudoacacia	5	FACU-	4.33	0.24
	TOTAL:	100		Plot Indic.Val.	4.28

Quadrat Data					
Site Name:	Angelica Creek Restoration Site		Investigators:	SLJ/JG	
Quadrat ID:	B+000		Date:	5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
oxeye daisy	Leucanthemum vulgare	50	UPL	5.00	2.5
Fuller's teasel	Dipsacus fullonum	25	I, NI	5.00	1.25
Kentucky bluegrass	Poa pratensis	15	FACU	4.00	0.6
purple loosestrife	Lythrum salicaria	5	FACW+	1.67	0.0835
wild carrot	Daucus carota	5	I, NI	5.00	0.25
	TOTAL:	100		Plot Indic.Val.	4.6835

Quadrat Data					
Site Name:	Angelica Creek Restoration Site		Investigators:	SLJ/JG	
Quadrat ID:	B+100		Date:	5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
bare ground/ dead vegetation	-	85	-	-	-
purple loosestrife	Lythrum salicaria	10	FACW+	1.67	1.67
unID herb	-	5	-	-	-
	TOTAL:	100		Plot Indic.Val.	1.67

Quadrat Data					
Site Name:	Angelica Creek Restoration Site		Investigators:	SLJ/JG	
Quadrat ID:	B+200		Date:	5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
bare ground/ dead vegetation	-	30	-	-	-
reed canary grass	<i>Phalaris arundinacea</i>	25	FACW+	1.67	0.70
dark green bulrush	<i>Scirpus atrovirens</i>	25	OBL	1.00	0.42
dwarf St. John's wort	<i>Hypericum mutilum</i>	15	FACW	2.00	0.50
open water	-	10	-	-	-
	TOTAL:	105		Plot Indic.Val.	1.61

Quadrat Data					
Site Name:	Angelica Creek Restoration Site		Investigators:	SLJ/JG	
Quadrat ID:	B+300		Date:	5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
bare ground/ dead vegetation	-	50	-	-	-
reed canary grass	Phalaris arundinacea	25	FACW+	1.67	0.93
purple loosestrife	Lythrum salicaria	15	FACW+	1.67	0.56
dark green bulrush	Scirpus atrovirens	5	OBL	1.00	0.11
open water	-	5	-	-	-
TOTAL:		100		Plot Indic.Val.	1.60

Quadrat Data					
Site Name:	Angelica Creek Restoration Site		Investigators:	SLJ/JG	
Quadrat ID:	B+400		Date:	5/18/2009	
HERBACEOUS VEGETATION:					
Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
reed canary grass	<i>Phalaris arundinacea</i>	25	FACW+	1.67	0.4175
purple loosestrife	<i>Lythrum salicaria</i>	25	FACW+	1.67	0.4175
fowl bluegrass	<i>Poa palustris</i>	15	FAC	3.00	0.45
soft rush	<i>Juncus effusus</i>	10	FACW+	1.67	0.167
blue vervain	<i>Verbena hastata</i>	10	FACW+	1.67	0.167
common sowthistle	<i>Sonchus arvensis</i>	10	UPL	5.00	0.5
oxeye daisy	<i>Leucanthemum vulgare</i>	5	UPL	5.00	0.25
	TOTAL:	100		Plot Indic.Val.	2.369

Quadrat Data

Site Name: Angelica Creek Restoration Site **Investigators:** SLJ/JG
Quadrat ID: B+500 **Date:** 5/18/2009

HERBACEOUS VEGETATION:

Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
bare ground/ dead vegetation	-	40	-	-	-
reed canarygrass	<i>Phalaris arundinacea</i>	25	FACW+	1.67	0.76
annual ragweed	<i>Ambrosia artemisiifolia</i>	15	FACU	4.00	1.09
purple loosestrife	<i>Lythrum salicaria</i>	10	FACW+	1.67	0.30
jewelweed	<i>Impatiens capensis</i>	5	FACW+	1.67	0.15
unID herb	-	5	-	-	-
white snakeroot	<i>Ageratina altissima</i>	T	FACU-	4.33	-
TOTAL:		100		Plot Indic.Val.	2.31

Quadrat Data

Site Name: Angelica Creek Restoration Site **Investigators:** SLJ/JG
Quadrat ID: B+600 **Date:** 5/18/2009

HERBACEOUS VEGETATION:

Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
jewelweed	<i>Impatiens capensis</i>	25	FACW+	1.67	0.52
purple loosestrife	<i>Lythrum salicaria</i>	25	FACW+	1.67	0.52
field horsetail	<i>Equisetum arvense</i>	15	FAC	3.00	0.56
bare ground/ dead vegetation	-	15	-	-	-
reed canarygrass	<i>Phalaris arundinacea</i>	10	FACW+	1.67	0.21
goldenrod sp.	<i>Solidago sp.</i>	5	-	-	-
black willow	<i>Salix nigra</i>	5	FACW+	1.67	0.10
TOTAL:		100		Plot Indic.Val.	1.92

Quadrat Data

Site Name: Angelica Creek Restoration Site **Investigators:** SLJ/JG
Quadrat ID: B+700 **Date:** 5/18/2009

HERBACEOUS VEGETATION:

Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
reed canarygrass	<i>Phalaris arundinacea</i>	25	FACW+	1.67	0.56
purple loosestrife	<i>Lythrum salicaria</i>	25	FACW+	1.67	0.56
goldenrod sp.	<i>Solidago sp.</i>	25	-	-	-
oxeye daisy	<i>Leucanthemum vulgare</i>	20	UPL	5.00	1.33
common dandelion	<i>Taraxacum officinale</i>	5	FACU-	4.33	0.29
boneset	<i>Eupatorium perfoliatum</i>	T	FACW+	-	-
TOTAL:		100		Plot Indic.Val.	2.74

Quadrat Data

Site Name: Angelica Creek Restoration Site **Investigators:** SLJ/JG
Quadrat ID: B+800 **Date:** 5/18/2009

HERBACEOUS VEGETATION:

Common Name	Scientific Name	% Cover	Indicator Status	Indicator Value	Weighted Value
annual ragweed	<i>Ambrosia artemisiifolia</i>	40	FACU	4.00	2
goldenrod sp.	<i>Solidago sp.</i>	20	-	-	-
oxeye daisy	<i>Leucanthemum vulgare</i>	15	UPL	5.00	0.9375
crown vetch	<i>Securigera varia</i>	10	NL, I	5.00	0.625
spotted tearthumb	<i>Polygonum persicaria</i>	10	FACW	2.00	0.25
morning glory	<i>Ipomoea eriocarpa</i>	5	NL	5.00	0.3125
wild carrot	<i>Daucus carota</i>	T	I, NL	5.00	-
TOTAL:		100		Plot Indic.Val.	4.125

APPENDIX B:
COMPOSITE VEGETATION
LIST BY HABITAT

Appendix B: Composite Vegetation Lists By Habitat

Composite List: Deep Pond and Pond Edge

<i>Scientific Name</i>	Common Name	Volunteer Species (Y/N)
<i>Cercis canadensis</i>	redbud	Y
<i>Eleocharis ovata</i>	ovate spikerush	Y
<i>Eupatorium perfoliatum</i>	boneset	N
<i>Iris versicolor</i>	blueflag iris	N
<i>Juncus effusus</i>	soft rush	Y
<i>Ludwigia palustris</i>	marsh seedbox	Y
<i>Lythrum salicaria</i>	purple loosestrife	Y*
<i>Peltandra virginica</i>	arrow arum	N
<i>Polygonum persicaria</i>	lady's tearthumb	Y
<i>Pontederia cordata</i>	pickerel weed	N
<i>Scirpus atrovirens</i>	common bulrush	N
<i>Typha latifolia</i>	broadleaf cattail	Y

* = invasive species

Composite List: Wetland 1

<i>Scientific Name</i>	Common Name	Volunteer Species (Y/N)
<i>Acer rubrum</i>	red maple	Y
<i>Ambrosia artemisiifolia</i>	annual ragweed	Y
<i>Aster novae-angliae</i>	New England aster	N
<i>Carex lurida</i>	shallow sedge	N
<i>Carex stricta</i>	tussock sedge	Y
<i>Carex vulpinoidea</i>	fox sedge	N
<i>Conyza canadensis</i>	horseweed	Y
<i>Dactylis glomerata</i>	orchard grass	Y
<i>Daucus carota</i>	wild carrot	Y
<i>Dipsacus fullonum</i>	Fuller's teasel	Y
<i>Elymus virginicus</i>	Virginia wild rye	N
<i>Eupatorium perfoliatum</i>	boneset	N
<i>Humulus japonicus</i>	Japanese hops	Y*
<i>Impatiens capensis</i>	jewelweed	Y
<i>Iris versicolor</i>	blue flag	N
<i>Juncus effusus</i>	soft rush	N
<i>Juncus tenuis</i> , PA Ecotype	slender rush	N
<i>Leucanthemum vulgare</i> / <i>Chrysanthemum leucanthemum</i>	oxeye daisy	N
<i>Lilium superbum</i>	Turk's cap lily	N
<i>Linaria vulgaris</i>	butter-and-eggs	Y
<i>Ludwigia palustris</i>	marsh seedbox	Y
<i>Lythrum salicaria</i>	purple loosestrife	Y*
<i>Mimulus ringens</i>	square-stemmed monkey flower	N
<i>Morus alba</i>	white mulberry	Y
<i>Oenothera biennis</i>	evening primrose	Y
<i>Oxalis europaea</i>	yellow woodsorrel	Y
<i>Panicum virgatum</i>	switchgrass	N
<i>Persicaria perfoliata</i>	mile-a-minute	Y*
<i>Phalaris arundinacea</i>	reed canary grass	Y*
<i>Poa palustris</i>	fowl bluegrass	N
<i>Poa pratensis</i>	Kentucky bluegrass	Y
<i>Robinia pseudoacacia</i>	black locust	Y*
<i>Salix nigra</i>	black willow	Y
<i>Scirpus atrovirens</i>	green bulrush	N
<i>Solidago</i> sp.	goldenrod sp.	Y
<i>Sparganium eurycarpum</i>	giant bur reed	N
<i>Taraxacum officinale</i>	common dandelion	Y
<i>Trifolium pratense</i>	red clover	Y
<i>Trifolium repens</i>	white clover	Y
<i>Typha latifolia</i>	broadleaf cattail	Y
<i>Verbena hastata</i>	blue vervain	N
<i>Viburnum dentatum</i>	arrowwood	N

* = invasive species

Composite List: Wetland 2

Scientific Name	Common Name	Volunteer Species (Y/N)
<i>Acer saccharinum</i>	silver maple	Y
<i>Carex lurida</i>	shallow sedge	N
<i>Carex stricta</i>	tussock sedge	Y
<i>Carex vulpinoidea</i>	fox sedge	N
<i>Dipsacus fullonum</i>	Fuller's teasel	Y
<i>Echinichloa crusgalli</i>	rough barnyard grass	Y
<i>Eleocharis sp.</i>	spikerush	Y
<i>Elymus virginicus</i>	Virginia wild rye	N
<i>Eupatorium perfoliatum</i>	boneset	N
<i>Humulus japonicus</i>	Japanese hops	Y*
<i>Hypericum mutilum</i>	dwarf St. John's wort	Y
<i>Impatiens capensis</i>	jewelweed	Y
<i>Iris versicolor</i>	blue flag	N
<i>Juncus effusus</i>	soft rush	N
<i>Juncus tenuis</i> , PA Ecotype	slender rush	N
<i>Lemna minor</i>	duckweed	Y
<i>Leucanthemum vulgare</i> / <i>Chrysanthemum leucanthemum</i>	oxeye daisy	N
<i>Lilium superbum</i>	Turk's cap lily	N
<i>Ludwigia palustris</i>	marsh seedbox	Y
<i>Lythrum salicaria</i>	purple loosestrife	Y*
<i>Mimulus ringens</i>	square-stemmed monkey flower	N
<i>Panicum virgatum</i>	switchgrass	N
<i>Peltandra virginica</i>	arrow arum	N
<i>Persicaria perfoliata</i>	mile-a-minute	Y*
<i>Phalaris arundinacea</i>	reed canary grass	Y*
<i>Phragmites australis</i>	common reed	Y*
<i>Poa palustris</i>	fowl bluegrass	N
<i>Pontederia cordata</i>	pickerel weed	N
<i>Robinia psuedoacacia</i>	black locust	Y*
<i>Salix nigra</i>	black willow	Y
<i>Scirpus atrovirens</i>	green bulrush	N
<i>Sonchus arvensis</i>	common sowthistle	Y
<i>Typha latifolia</i>	broadleaf cattail	Y
<i>Verbena hastata</i>	blue vervain	N

* = invasive species

Composite List: Meadow

Scientific Name	Common Name	Volunteer Species (Y/N)
<i>Ageratina altissima</i>	white snakeroot	Y
<i>Ambrosia artemisiifolia</i>	annual ragweed	N
<i>Apocynum cannabinum</i>	hemp dogbane	Y
<i>Arctium minus</i>	burdock	Y
<i>Aster noviae-angliae</i>	New England aster	N
<i>Barbarea vulgaris</i>	yellow rocket	Y
<i>Cichorium intybus</i>	blue chicory	N
<i>Cirsium arvense</i>	Canada thistle	Y*
<i>Daucus carota</i>	wild carrot	Y
<i>Dipsacus fullonum</i>	Fuller's teasel	Y
<i>Eupatorium perfoliatum</i>	boneset	N
<i>Humulus japonicus</i>	Japanese hops	Y*
<i>Ipomoea eriocarpa</i>	morning glory	Y
<i>Juncus tenuis</i>	slender rush	N
<i>Leucanthemum vulgare/</i> <i>Chrysanthemum leucanthemum</i>	ox-eye daisy	N
<i>Lythrum salicaria</i>	purple loosestrife	Y*
<i>Oenothera biennis</i>	common primrose	Y
<i>Panicum virgatum</i>	switch grass	N
<i>Phalaris arundinacea</i>	reed canarygrass	Y*
<i>Phragmites australis</i>	common reed	Y*
<i>Poa palustris</i>	fowl bluegrass	N
<i>Poa pratensis</i>	Kentucky bluegrass	Y
<i>Polygonum persicaria</i>	spotted tearthumb	Y
<i>Rhus typhina</i>	staghorn sumac	Y
<i>Robinia psuedoacacia</i>	black locust	Y*
<i>Securigera varia</i>	crown vetch	Y
<i>Solidago sp.</i>	goldenrod sp.	Y
<i>Sonchus arvensis</i>	common sowthistle	Y
<i>Taraxacum officinale</i>	common dandelion	Y
<i>Trifolium pratense</i>	red clover	Y
<i>Trifolium repens</i>	white clover	Y
<i>Verbascum thapsus</i>	common mullein	Y

* = invasive species

Composite List: Riverine Riparian

<i>Scientific Name</i>	Common Name	Volunteer Species (Y/N)
<i>Acer rubrum</i>	red maple	Y
<i>Acer saccharinum</i>	silver maple	Y
<i>Ageratina altissima</i>	white snakeroot	Y
<i>Ambrosia artemisiifolia</i>	annual ragweed	N
<i>Arctium minus</i>	burdock	Y
<i>Barbarea vulgaris</i>	yellow rocket	Y
<i>Carex lurida</i>	shallow sedge	N
<i>Carex stricta</i>	tussock sedge	Y
<i>Carex vulpinoidea</i>	fox sedge	N
<i>Cirsium arvense</i>	Canada thistle	Y*
<i>Cyperus esculentus</i>	yellow nutsedge	Y
<i>Dactylis glomerata</i>	orchard grass	Y
<i>Daucus carota</i>	wild carrot	Y
<i>Dipsacus fullonum</i>	Fuller's teasel	Y
<i>Echinichloa crusgalli</i>	rough barnyard grass	Y
<i>Equisetum arvense</i>	field horsetail	Y
<i>Eupatorium perfoliatum</i>	boneset	N
<i>Humulus japonicus</i>	Japanese hops	Y*
<i>Impatiens capensis</i>	jewelweed	Y
<i>Juncus effusus</i>	soft rush	N
<i>Juncus tenuis</i> , PA Ecotype	slender rush	N
<i>Leucanthemum vulgare</i> / <i>Chrysanthemum leucanthemum</i>	ox-eye daisy	N
<i>Lythrum salicaria</i>	purple loosestrife	Y*
<i>Mimulus ringens</i>	square-stemmed monkey flower	
<i>Oenothera biennis</i>	evening primrose	Y
<i>Oxalis europaea</i>	yellow woodsorrel	Y
<i>Persicaria perfoliata</i>	mile-a-minute	Y*
<i>Phalaris arundinacea</i>	reed canarygrass	Y*
<i>Poa palustris</i>	fowl bluegrass	N
<i>Robinia pseudoacacia</i>	black locust	Y*
<i>Salix nigra</i>	black willow	Y
<i>Solidago sp.</i>	goldenrod sp.	Y
<i>Sonchus arvensis</i>	common sowthistle	Y
<i>Taraxacum officinale</i>	common dandelion	Y
<i>Urtica dioica</i>	stinging nettle	Y
<i>Verbena hastata</i>	blue vervain	N

* = invasive species

APPENDIX C:
VEGETATION SEED MIXES
BY HABITAT

Appendix C

Seed Lists by Ecotype

Master List of Seeded Vegetation

Scientific Name	Common Name
<i>Achillea millefolium</i>	white yarrow
<i>Agrostis scabra</i>	ticklegrass (rough bentgrass)
<i>Andropogon gerardii</i> , <i>Niagara</i>	Niagara big bluestem
<i>Andropogon scoparius</i> , <i>Camper</i>	little bluestem, camper
<i>Asclepias incarnata</i>	swamp milkweed
<i>Asclepias syriaca</i>	common milkweed
<i>Asclepias tuberosa</i>	butterfly milkweed
<i>Aster novae-angliae</i>	New England aster
<i>Aster Prenanthoides</i>	zigzag aster
<i>Aster novi-belgi</i>	New York aster
<i>Aster umbellatus</i>	flat topped white aster
<i>Baptisia australis</i> , <i>WV ecotype</i>	blue false indigo, WV ecotype
<i>Bidens frondosa</i>	beggar ticks
<i>Bouteloua curtipendula</i> , <i>Butte</i>	butte side oats grama
<i>Bromus altissima</i>	wild brome grass
<i>Bromus ciliatus</i>	fringed brome grass
<i>Caltha palustris</i>	marsh marigold
<i>Carex baileyi</i>	Bailey's sedge
<i>Carex comosa</i>	cosmos/bristly sedge
<i>Carex comosa</i>	cosmos/bristly sedge
<i>Carex crinita</i>	fringed (nodding) sedge
<i>Carex lupulina</i>	hop sedge
<i>Carex lurida</i>	lurid/shallow sedge
<i>Carex scoparia</i>	blunt broom sedge
<i>Carex stipata</i>	awl sedge
<i>Carex tuckermanii</i>	Tuckerman's sedge
<i>Carex vulpinoidea</i>	fox sedge
<i>Chamaecrista fasciculata</i>	partridge pea
<i>Chrysanthemum leucanthemum</i>	ox eye daisy
<i>Cichorium intybus</i>	blue chicory
<i>Coreopsis lanceolata</i> , <i>NC Ecotype</i>	lance leaved coreopsis, NC ecotype
<i>Coreopsis tinctoria</i>	plains coreopsis
<i>Cornus amomum</i>	silky dogwood
<i>Desmodium canadense</i>	showy tick trefoil
<i>Elymus canadensis</i>	Canada wild rye
<i>Elymus riparius</i>	riverbank wild rye
<i>Elymus villosus</i>	silky wild rye
<i>Elymus virginicus</i>	Virginia wild rye
<i>Eupatorium fistulosum</i>	joe pye weed
<i>Eupatorium maculatum</i>	spotted joe pye weed
<i>Eupatorium perfoliatum</i>	boneset
<i>Euthamia graminifolia</i>	grass leaved goldenrod
<i>Festuca ovina</i>	sheep fescue, variety not stated
<i>Glyceria canadensis</i>	rattlesnake grass
<i>Glyceria striata</i>	fowl mannagrass
<i>Glyceria grandis</i>	American mannagrass
<i>Hamamelis virginiana</i>	witch hazel
<i>Helenium autumnale</i> <i>PA or VA Ecotype</i>	common sneezeweed, PA or VA ecotype

Scientific Name	Common Name
<i>Heliopsis helianthoides</i>	ox-eye sunflower
<i>Hypericum pyramidatum</i>	great St. John's wort
<i>Iris versicolor</i>	blueflag iris
<i>Juncus effusus</i>	soft rush
<i>Juncus tenuis</i> , PA Ecotype	path rush, PA ecotype
<i>Lespedeza capitata</i>	roundhead lespedeza
<i>Liatris spicata</i>	marsh (dense) blazing star (spiked gayfeather)
<i>Lilium superbum</i>	Turk's cap lilly
<i>Lolium multiflorum</i>	annual ryegrass
<i>Lupinus perennis</i>	wild blue lupine
<i>Mimulus ringens</i>	square stemmed monkey flower
<i>Monarda fistulosa</i>	wild bergamot
<i>Panicum amarum</i>	Atlantic coastal panic grass
<i>Panicum virgatum</i> , Shelter	switch grass, shelter
<i>Peltandra virginica</i>	arrow arum
<i>Penstemon digitalis</i>	tall white beard tongue
<i>Penthorum sedoides</i>	ditch stonecrop
<i>Poa palustris</i>	fowl bluegrass
<i>Pontederia cordata</i>	pickerel weed
<i>Rhus typhina</i>	staghorn sumac
<i>Rudbeckia hirta</i> , NC Ecotype	black eyed Susan, NC ecotype
<i>Sambucus canadensis</i>	elderberry
<i>Scirpus acutus</i>	hard stemmed bulrush
<i>Scirpus atrovirens</i>	common bulrush
<i>Scirpus atrovirens</i>	green bulrush
<i>Scirpus polyphyllus</i>	many leaved bulrush
<i>Scirpus validus</i>	soft stem bulrush
<i>Senna hebecarpa</i> , VA or WV Ecotype	wild senna, VA or WV ecotype
<i>Setaria italica</i>	german foxtail millet
<i>Sorghastrum nutans</i> , Holt	indian grass, holt
<i>Sparganium americanum</i>	eastern lesser bur reed
<i>Sparganium eurycarpum</i>	giant bur reed
<i>Tradescantia ohioensis</i>	Ohio spiderwort
<i>Tradescantia virginiana</i> , PA/VA	Virginia spiderwort, PA and VA ecotype blend
<i>Tripsacum dactyloides</i>	eastern gamma grass
<i>Verbena hastata</i>	blue vervain
<i>Vernonia gigantea</i>	giant ironweed
<i>Viburnum dentatum</i>	arrow wood
<i>Zizia aurea</i>	golden Alexanders

Wetland 1 Seed Mix

Scientific Name	Common Name
<i>Asclepias incarnata</i>	swamp milkweed
<i>Aster novae-angliae</i>	New England aster
<i>Aster umbellatus</i>	flat topped white aster
<i>Bidens frondosa</i>	beggar ticks
<i>Bromus altissima</i>	wild brome grass
<i>Caltha palustris</i>	marsh marigold
<i>Carex baileyi</i>	bailey's sedge
<i>Carex comosa</i>	cosmos/bristly sedge
<i>Carex crinita</i>	fringed (nodding) sedge
<i>Carex lupulina</i>	hop sedge
<i>Carex lurida</i>	lurid/shallow sedge
<i>Carex scoparia</i>	blunt broom sedge
<i>Carex stipata</i>	awl sedge
<i>Carex tuckermanii</i>	Tuckerman's sedge
<i>Carex vulpinoidea</i>	fox sedge
<i>Elymus virginicus</i>	Virginia wild rye
<i>Eupatorium fistulosum</i>	joe pye weed
<i>Eupatorium maculatum</i>	spotted joe pye weed
<i>Eupatorium perfoliatum</i>	boneset
<i>Glyceria canadensis</i>	rattlesnake grass
<i>Glyceria striata</i>	fowl mannagrass
<i>Glyceria grandis</i>	American mannagrass
<i>Helenium autumnale</i> PA or VA Ecotype	common sneezeweed, PA or VA Ecotype
<i>Heliopsis helianthoides</i>	ox-eye sunflower
<i>Iris versicolor</i>	blue flag
<i>Juncus effusus</i>	soft rush
<i>Juncus tenuis</i> , PA Ecotype	path rush, PA ecotype
<i>Lilium superbum</i>	Turk's cap lily
<i>Mimulus ringens</i>	square stemmed monkey flower
<i>Penthorum sedoides</i>	ditch stonecrop
<i>Scirpus acutus</i>	hard stemmed bulrush
<i>Scirpus atrovirens</i>	green bulrush
<i>Scirpus polyphyllus</i>	many leaved bulrush
<i>Scirpus validus</i>	soft stem bulrush
<i>Sparganium americanum</i>	eastern lesser bur reed
<i>Sparganium eurycarpum</i>	giant bur reed
<i>Verbena hastata</i>	blue vervain
<i>Vernonia gigantea</i>	giant ironweed
<i>Zizia aurea</i>	golden Alexanders

Pond/Deep Water Seed/Plug Mix (Wetland 1, Wetland 2)

Scientific Name	Common Name
<i>Iris versicolor</i>	blueflag iris
<i>Peltandra virginica</i>	arrow arum
<i>Pontederia cordata</i>	pickerel weed
<i>Scirpus atrovirens</i>	common bulrush

Meadow Seed Mix

Scientific Name	Common Name
<i>Achillea millefolium</i>	white yarrow
<i>Agrostis scabra</i>	ticklegass (rough bentgrass)
<i>Andropogon gerardii</i> , <i>Niagara</i>	Niagara big bluestem
<i>Andropogon scoparius</i> , <i>Camper</i>	little bluestem, camper
<i>Asclepias syriaca</i>	common milkweed
<i>Asclepias tuberosa</i>	butterfly milkweed
<i>Aster novae-angliae</i>	New England aster
<i>Aster prenanthoides/novi-belgi</i> mix	zigzag aster/New York aster mix
<i>Baptisia australis</i> , <i>WV ecotype</i>	blue false indigo, WV ecotype
<i>Bouteloua curtipendula</i> , <i>Butte</i>	butte side oats grama
<i>Bromus ciliatus</i>	fringed brome grass
<i>Chamaecrista fasciculata</i>	partridge pea
<i>Chrysanthemum leucanthemum</i>	ox eye daisy
<i>Cichorium intybus</i>	blue chicory
<i>Coreopsis lanceolata</i> , <i>NC Ecotype</i>	lance leaved coreopsis, NC ecotype
<i>Coreopsis tinctoria</i>	plains coreopsis
<i>Desmodium canadense</i>	showy tick trefoil
<i>Elymus canadensis</i>	Canada wild rye
<i>Elymus villosus</i>	silky wild rye
<i>Festuca ovina</i>	sheep fescue, variety not stated
<i>Heliopsis helianthoides</i>	ox eye sunflower
<i>Hypericum pyramidatum</i>	great St. John's wort
<i>Lespedeza capitata</i>	roundhead lespedeza
<i>Liatris spicata</i>	marsh (dense) blazing star (spiked gayfeather)
<i>Lolium multiflorum</i>	annual ryegrass
<i>Lupinus perennis</i>	wild blue lupine
<i>Monarda fistulosa</i>	wild bergamot
<i>Panicum amarum</i>	Atlantic coastal panic grass
<i>Panicum virgatum</i> , <i>Shelter</i>	switch grass, shelter
<i>Penstemon digitalis</i>	tall white beard tongue
<i>Poa palustris</i>	fowl bluegrass
<i>Rudbeckia hirta</i> , <i>NC Ecotype</i>	black eyed Susan, NC ecotype
<i>Senna hebecarpa</i> , <i>VA or WV Ecotype</i>	wild senna, VA or WV ecotype blend
<i>Sorghastrum nutans</i> , <i>Holt</i>	Indian grass, holt
<i>Tradescantia ohioensis</i>	Ohio spiderwort
<i>Tradescantia virginiana</i> , <i>PA/VA</i>	Virginia spiderwort, PA and VA ecotype blend
<i>Tripsacum dactyloides</i>	eastern gamma grass
<i>Zizia aurea</i>	golden Alexanders

Wetland 2 Seed Mix

Scientific Name	Common Name
<i>Asclepias incarnata</i>	swamp milkweed
<i>Aster novae-angliae</i>	New England aster
<i>Aster umbellatus</i>	flat topped white aster
<i>Bidens frondosa</i>	beggar ticks
<i>Bromus altissima</i>	wild brome grass
<i>Caltha palustris</i>	marsh marigold
<i>Carex baileyi</i>	bailey's sedge
<i>Carex comosa</i>	cosmos/bristly sedge
<i>Carex crinita</i>	fringed (nodding) sedge
<i>Carex lupulina</i>	hop sedge
<i>Carex lurida</i>	lurid/shallow sedge
<i>Carex scoparia</i>	blunt broom sedge
<i>Carex stipata</i>	awl sedge
<i>Carex tuckermanii</i>	Tuckerman's sedge
<i>Carex vulpinoidea</i>	fox sedge
<i>Elymus virginicus</i>	Virginia wild rye
<i>Eupatorium fistulosum</i>	joe pye weed
<i>Eupatorium maculatum</i>	spotted joe pye weed
<i>Eupatorium perfoliatum</i>	boneset
<i>Glyceria canadensis</i>	rattlesnake grass
<i>Glyceria striata</i>	fowl mannagrass
<i>Glyceria grandis</i>	American mannagrass
<i>Helenium autumnale</i> PA or VA Ecotype	common sneezeweed pa or va ecotype
<i>Helianthus helianthoides</i>	ox-eye sunflower
<i>Iris versicolor</i>	blue flag
<i>Juncus effusus</i>	soft rush
<i>Juncus tenuis</i> , PA Ecotype	path rush, pa ecotype
<i>Lilium superbum</i>	Turk's cap lily
<i>Mimulus ringens</i>	square stemmed monkey flower
<i>Penthorum sedoides</i>	ditch stonecrop
<i>Scirpus acutus</i>	hard stemmed bulrush
<i>Scirpus atrovirens</i>	green bulrush
<i>Scirpus polyphyllus</i>	many leaved bulrush
<i>Scirpus validus</i>	soft stem bulrush
<i>Sparganium americanum</i>	eastern lesser bur reed
<i>Sparganium eurycarpum</i>	giant bur reed
<i>Verbena hastata</i>	blue vervain
<i>Vernonia gigantea</i>	giant ironweed
<i>Zizia aurea</i>	golden Alexanders

Riverine Riparian Seed Mix

Scientific Name	Common Name
<i>Andropogon gerardii, Niagara</i>	Niagara big bluestem
<i>Andropogon scoparius</i>	little bluestem
<i>Asclepias incarnata</i>	swamp milkweed
<i>Asclepias syriaca</i>	common milkweed
<i>Aster Prenanthoides</i>	zigzag aster
<i>Baptisia australis</i>	blue false indigo
<i>Carex vulpinoidea</i>	fox sedge
<i>Chamaecrista fasciculata</i>	partridge pea
<i>Cornus amomum</i>	silky dogwood
<i>Desmodium canadense</i>	showy tick trefoil
<i>Elymus riparius</i>	riverbank wild rye
<i>Elymus virginicus</i>	Virginia wild rye
<i>Eupatorium fistulosum</i>	joe pye weed
<i>Eupatorium perfoliatum</i>	boneset
<i>Euthamia graminifolia</i>	grass leaved goldenrod
<i>Glyceria striata</i>	fowl mannagrass
<i>Hamamelis virginiana</i>	witch hazel
<i>Helenium autumnale</i>	common sneezeweed
<i>Heliopsis helianthoides</i>	ox eyed sunflower/false
<i>Juncus effusus</i>	soft rush
<i>Lolium multiflorum</i>	annual ryegrass
<i>Monarda fistulosa</i>	wild bergamot
<i>Panicum Virgatum</i>	switch grass
<i>Penstemon digitalis</i>	tall white beard tongue
<i>Rhus typhina</i>	staghorn sumac
<i>Rudbeckia hirta</i>	black eyed Susan
<i>Sambucus canadensis</i>	elderberry
<i>Setaria italica</i>	German foxtail millet
<i>Sorghastrum nutans</i>	Indian grass
<i>Verbena hastata</i>	blue vervain
<i>Vernonia gigantea</i>	giant ironweed
<i>Viburnum dentatum</i>	arrow wood

APPENDIX D:
WOODY PLANT
SURVIVORSHIP DATA

Appendix D Planted Woody Vegetation Survivorship

Tree Species and Status Key

Status Abbreviation
A = Alive and healthy
S = Alive but stressed
D = Dead
M = Missing

Tree Abbreviation	Scientific Name	Common Name
AS	<i>Acer saccharinum</i>	silver maple
BN	<i>Betula nigra</i>	river birch
CC	<i>Carpinus caroliniana</i>	ironwood
FP	<i>Fraxinus pennsylvanica</i>	green ash
LT	<i>Liriodendron tulipifera</i>	tulip poplar
PO	<i>Palustris occidentalis</i>	sycamore
PS	<i>Pinus strobus</i>	white pine
QP	<i>Quercus palustris</i>	pin oak
QR	<i>Quercus rubra</i>	red oak

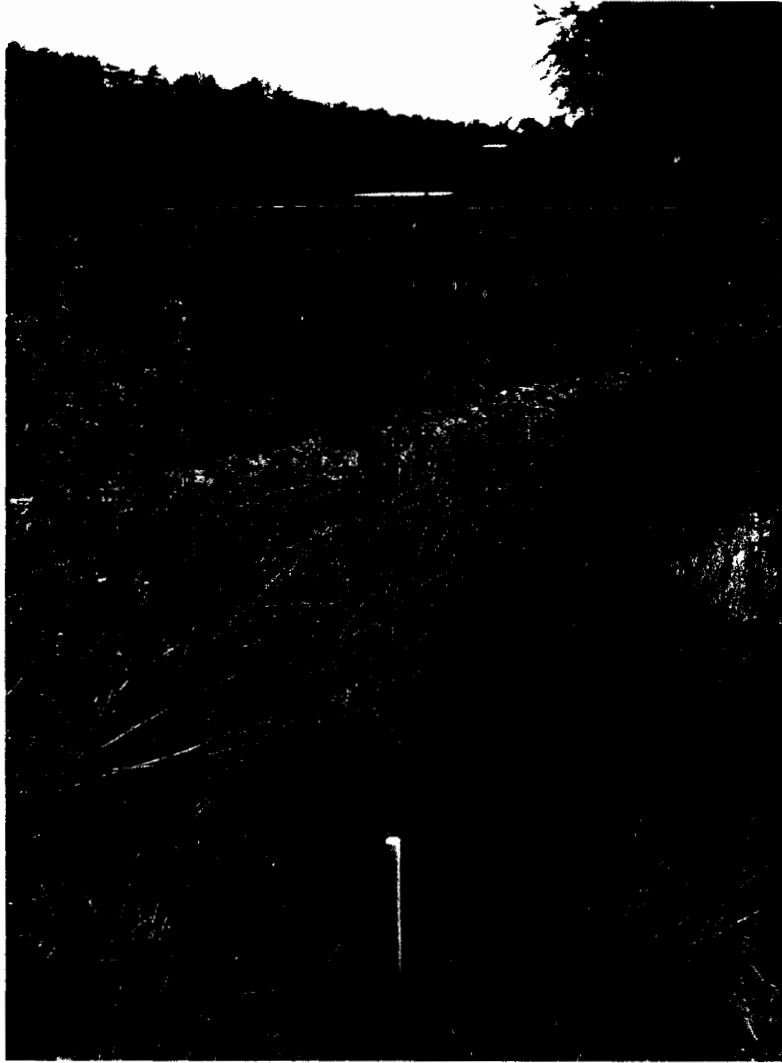
Species Abbreviation	Tree #	Status		Notes
		Fall 2008	Spring 2009	
AS	3	A	A	Tag missing
AS	4	A	A	Tag missing
AS	8	A	A	
AS	43	A	A	
AS	44	A	A	Tag missing
AS	45	A	A	
AS	49	A	A	
AS	56	A	A	Tag missing
AS	57	A	A	
AS	58	A	A	Bark damage
AS	59	A	A	
AS	60	S	S	
AS	78	A	A	
BN	5	A	A	
BN	6	A	A	
BN	7	A	A	Tag missing
BN	27	A	A	
BN	28	A	A	
BN	29	A	A	
BN	30	A	A	
BN	31	A	A	
BN	35	M	M	Tree missing
BN	37	A	A	
BN	38	A	A	
BN	40	A	A	
BN	41	A	A	
BN	42	A	A	
BN	50	A	A	

BN	51	A	A	
BN	52	A	A	
BN	61	A	A	
BN	62	A	A	
BN	63	A	A	
CC	32	A	A	Tag missing
CC	33	A	A	
CC	34	A	A	
CC	64	A	A	
CC	65	S	A	
CC	66	S	S	
CC	67	S	S	
CC	68	A	S	
FP	15	A	A	
FP	18	A	A	
LT	53	A	A	
LT	54	A	A	Bark damage
LT	55	A	A	
PO	1	A	A	Tag missing
PO	2	A	A	Tag missing
PO	9	A	A	
PO	10	A	A	
PO	14	M	A	Tag missing
PO	19	A	A	
PO	24	A	A	
PO	25	A	A	
PO	26	A	A	
PO	39	A	A	
PO	46	A	A	
PO	47	A	A	
PO	48	A	A	
PO	74	A	A	
PO	75	S	A	
PO	76	A	A	
PS	20	A	A	
PS	21	A	A	
PS	22	A	A	
PS	23	A	A	
PS	36	A	A	
PS	87	A	A	
PS	91	A	A	Tag missing
PS	93	A	A	
PS	95	A	S	Tag missing
PS	20A	A	A	Tag missing
QP	73	A	A	
QP	86	A	S	
QR	11	A	A	
QR	12	A	A	
QR	13	A	A	
QR	16	A	A	
QR	17	S	A	
QR	69	A	A	Tag missing
QR	70	A	A	

QR	71	A	A	
QR	72	A	A	
QR	79	A	A	
QR	80	A	S	
QR	81	A	A	
QR	82	A	A	
QR	83	A	A	
QR	84	A	S	
QR	85	A	A	
QR	88	A	A	
QR	89	A	M	Could not be located in May 2009
QR	90	A	A	Tag missing
QR	92	A	S	Tag missing
QR	94	A	S	Tag missing
QR	96	A	S	Tag missing
QR	97	A	A	Tag missing
QR	98	A	S	
QR	99	A	A	Tag missing
QR	100	A	A	Tag missing

Tree Species	Total Planted and Tagged	#A/S/D/M in 2008			
		Alive, Thriving (A)	Alive, Stressed (S)	Dead (D)	Missing (M)
AS	13	12	1	0	0
BN	20	19	0	0	1
CC	8	5	3	0	0
FP	2	2	0	0	0
LT	3	3	0	0	0
PO	16	16	0	0	0
PS	10	9	1	0	0
QP	2	1	1	0	0
QR	26	18	7	0	1
TOTAL	100	85	13	0	2

APPENDIX E:
SITE MONITORING
PHOTOGRAPHS



Photograph 1: View of the Wetland 1 basin, from the A+000 transect plot facing east (May 2009).



Photograph 2: View of deep water pond with submerged vegetation at the edge, from the upland meadow facing west (May 2009).



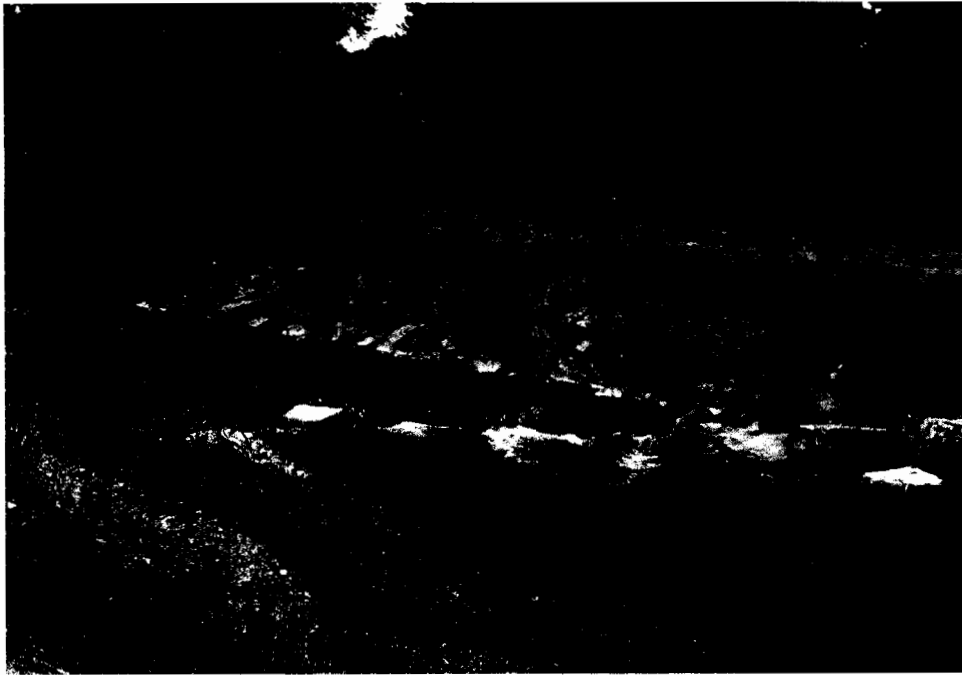
Photograph 3: View of the Wetland 2 basin from the path along Angelica Creek, facing south toward S.R. 0010. Dead vegetation from the previous growing season is in the foreground (May 2009).



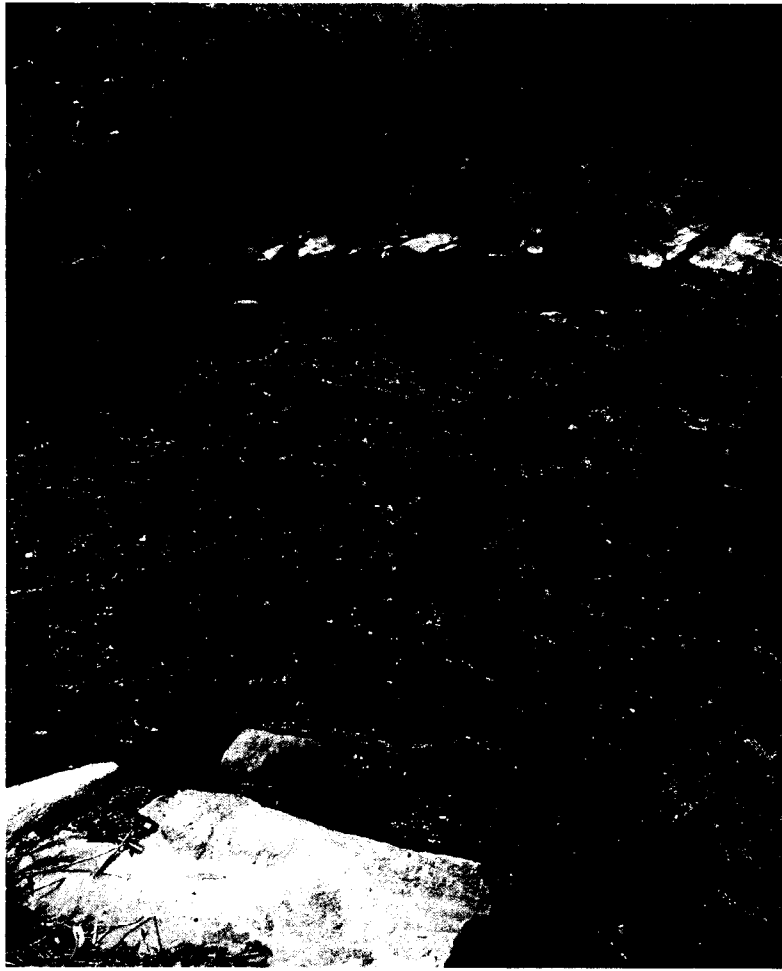
Photograph 4: View of the southern banks of Angelica Creek, from the trail facing east. This area is intended to be a riverine riparian zone and has recently been cleared of invasive vegetation (May 2009).



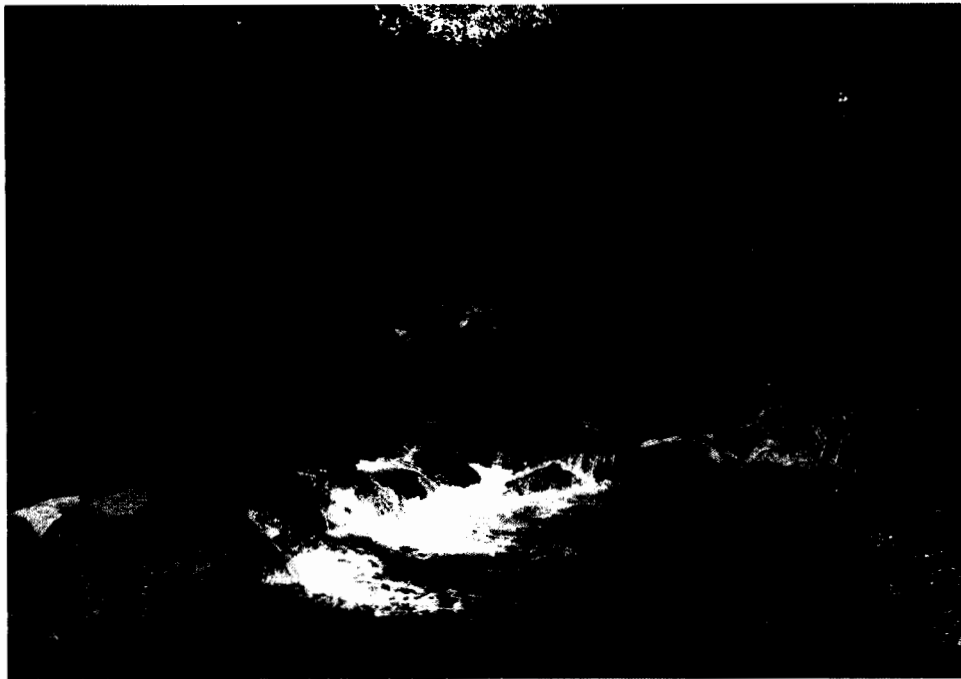
Photograph 5: View of upland meadow adjacent to Wetland 1, along the gravel path leading to the path near Wetland 1 (May 2009).



Photograph 6: View of Rock Cross Vane #1 (RV1), from the southern banks of Angelica Creek facing southwest (May 2009).



Photograph 7: View of Rock Cross Vane #2 (RV2), from the southern banks of Angelica Creek facing northwest across the waterway (May 2009).



Photograph 8: View of Rock Cross Vane #3 (RV3), from the southern banks of Angelica Creek facing southwest (May 2009).



Photograph 9: View of Rock Cross Vane #4 (RV4), from the southern banks of Angelica Creek facing northwest (May 2009).

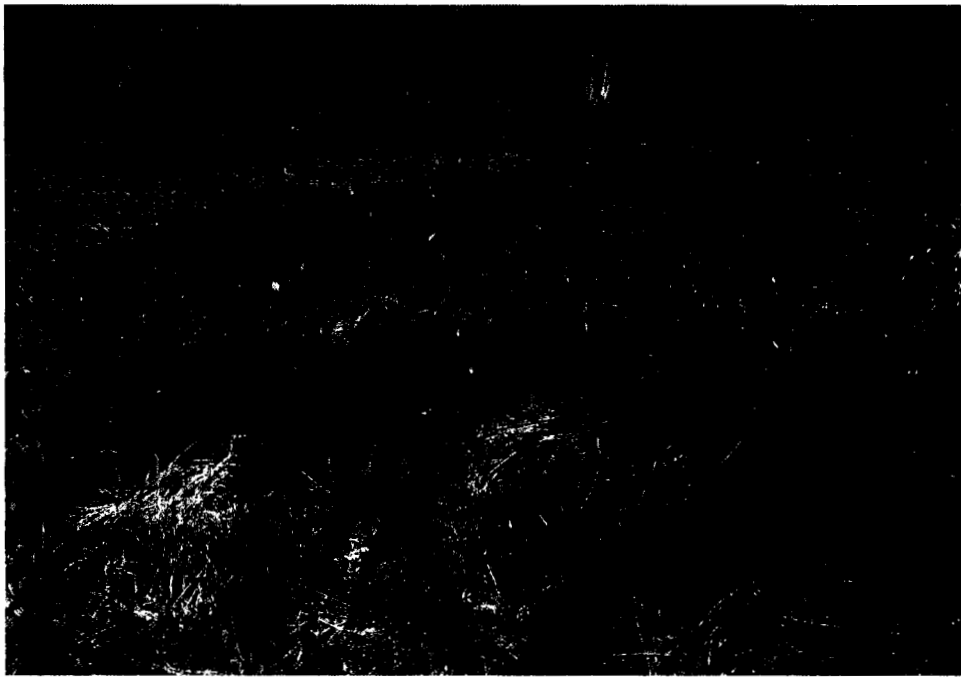


Photograph 10: View of Rock Cross Vane #5 (RV5), from the southern banks of Angelica Creek facing northwest toward the pedestrian bridge (May 2009).



Photograph 11: View of Rock Cross Vane #6 (RV6), from the southern banks of Angelica Creek facing southeast toward the S.R. 0010 bridge (May 2009).

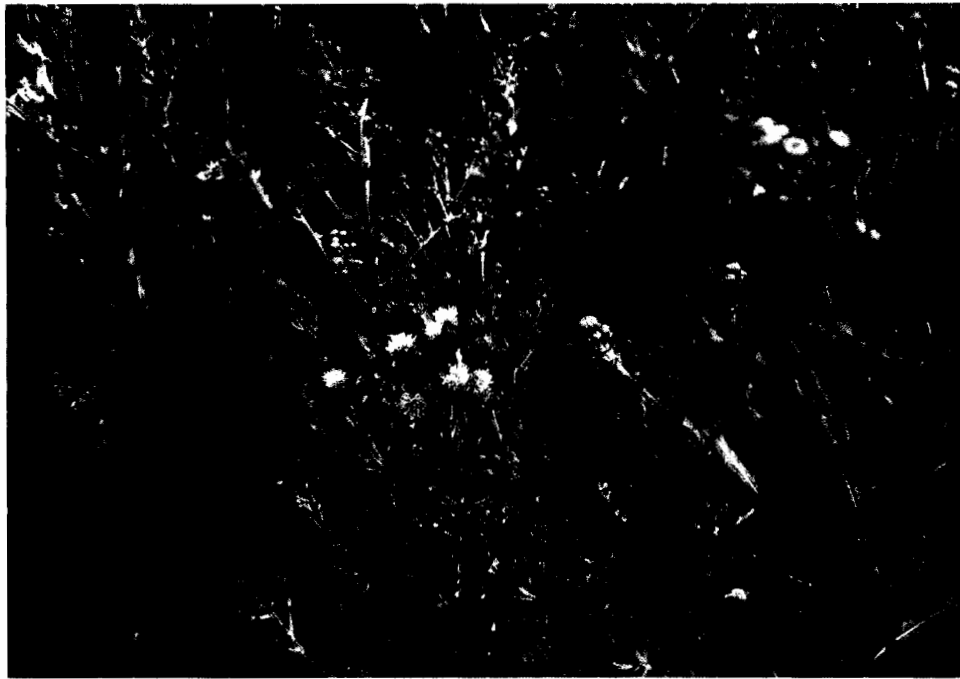
APPENDIX F:
SUPPLEMENTAL SITE
CONDITION PHOTOGRAPHS



Photograph A: View of the edge of Wetland 1, facing northeast towards the gravel path and Angelica Creek. Japanese hops, an invasive species, remains at the site, although most old growth was removed in April 2009 in accordance with the Maintenance Plan (May 2009).



Photograph B: View of the interior of Wetland 2, from the path facing northeast towards the railroad track and Route 10. A patch of the invasive common reed remains in the center, which should be monitored and removed, if necessary (May 2009).



Photograph C: In 2009, Canada thistle, a noxious weed of PA, was noted at the site, particularly in the upland meadow and riverine areas. It will be added to the list of invasive species to be eradicated as part of the maintenance plan (June 2009).



Photograph D: View of the pedestrian bridge and the gravel wash from the construction entrance onto the banks that was affecting planted silky dogwood shrubs during the first growing season (August 2008).



Photograph E: View of same area as Photograph D, from the path facing towards the banks. Although some of the gravel appears to be washed downstream or dispersed along the banks, the shrubs appeared stressed (May 2009).



Photograph F: View of Angelica Creek between the old pedestrian bridge and Rock Vane #4. The banks are eroded throughout this section and may require stabilization in the future (June 2009).



Photograph G: View of tracks in Wetland 2, possibly caused by maintenance vehicles (May 2009).



Photograph H: View of the tracks along the unpaved trail and edge of Wetland 2, possibly caused by maintenance vehicles (May 2009).



Photograph I: View of the meadow edge of Wetland 2 in June of 2008, when the plains coreopsis (right) and ox-eye sunflower (left) were blooming (June 2008).



Photograph J: View of the meadow edge and Wetland 2 in June of 2009, when the ox-eye daisy (white) and plains coreopsis (yellow) were blooming. The wildflower communities appear less dense in the second growing season (June 2009).

APPENDIX H:
CORRESPONDENCE AND PERMIT
DOCUMENTATION



Pennsylvania Department of Environmental Protection

909 Elmerton Avenue
Harrisburg, PA 17110-8200

AUG 18 2006

Southcentral Regional Office

717-705-4707
FAX - 717-705-4760

CERTIFIED MAIL NO. 7005 0390 0001 3161 2107

Charles M. Jones, P.E.
Public Works Director
503 North Sixth Street
Reading, PA 19601-3690

Re: Water Obstruction & Encroachment Permit
DEP File No. E06-610
APS ID No. 584491
Reading City, Berks County

Dear Mr. Jones:

Enclosed are duplicate copies of your Water Obstruction and Encroachment Permit. Please review the permit so that you are aware of the extent of authorization and conditions. **PLEASE SIGN BOTH COPIES OF THE WATER OBSTRUCTION & ENCROACHMENT PERMIT, RETURN THE FILE COPY TO THIS OFFICE WITHIN 15 DAYS AND KEEP THE OTHER COPY FOR YOUR RECORDS.** A self-addressed envelope is enclosed for your convenience. Please note that you do not have authorization to begin your project until DEP receives your signed copy of the Water Obstruction & Encroachment Permit. **IF YOU BEGIN WORK PRIOR TO DEP RECEIVING THE SIGNED COPY OF THE PERMIT, YOU ARE SUBJECT TO PENALTIES TOTALING UP TO \$10,000 PER DAY.** The Department will provide you with an acknowledgment letter upon receipt of the fully-signed permit.

Please be advised that you do not have federal authorization for this project and such authorization is required prior to starting your project. In accordance with procedures established with the U.S. Army Corps of Engineers, you will be contacted directly by the Corps regarding federal authorization.

Prior to the commencement of construction, the enclosed Acknowledgment of Appraisal of Permit Conditions must be completed and signed by you and an individual responsible for the supervision or conduct of the construction work acknowledging and accepting the general and special conditions contained in the permit. Unless the signed Acknowledgment of Appraisal of Permit Conditions is submitted to this office, the permit is void.

The Completion Report form must be signed by you and the supervising engineer indicating that the work has been completed as approved. The Completion Report must be submitted to this office within 30 days of the completion of the approved project.



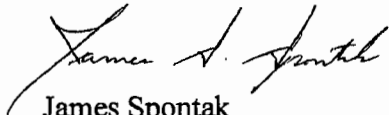
A copy of both the permit and the Acknowledgment of Appraisal of Permit Conditions must be available at the work site for inspection upon request by any officer or agent of DEP or any other federal, state, county and municipal agency.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa. C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, PO Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD.

IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717-787-3483) FOR MORE INFORMATION.

Sincerely,

A handwritten signature in dark ink, appearing to read "James A. Spontak", written in a cursive style.

James Spontak
Program Manager
Watershed Management Program

Enclosures

cc: Mike Campbell, A. D. Marble & Co.

Commonwealth of Pennsylvania
Department of Environmental Protection
Southcentral Regional Office
Watershed Management Program
Permitting and Technical Services Section

CHAPTER 106. FLOODPLAIN MANAGEMENT

The Department of Environmental Protection "DEP", established by the Act of December 3, 1970, P.L. 834 (71 P.S. §§ 510-1 et seq.) and empowered to exercise certain powers and perform certain duties under and by virtue of the Act of November 26, 1978, P.L. 1375, as amended by the Act of October 23, 1979, P.L. 204 (32 P.S. §§ 693.1 et seq.) known as the "Dam Safety and Encroachments Act"; Act of October 4, 1978, P.L. 851, (32 P.S. §§ 679.101 et seq.) known as the "Flood Plain Management Act"; Act of June 22, 1937, P.L. 1987, (35 P.S. §§ 691.1 et seq.), known as "The Clean Stearns Law"; and the Administrative Code, Act of April 9, 1929, P.L. 177, as amended, which empowers DEP to exercise certain powers and perform certain duties by law vested in and imposed upon the Water Supply Commission of Pennsylvania and the Water and Power Resources Board, hereby issues this permit to:

Charles M. Jones, P.E.
Public Works Director
503 North Sixth Street
Reading, PA 19601-3690

giving his consent to restore and maintain 1,600 linear feet of Angelica Creek (CWF), realign and maintain 400 feet of Angelica Creek (CWF), construct and maintain six cross rock vanes, five root wad structures, and four log vanes in Angelica Creek (CWF), two 1.0-acre wetlands, 0.5-acre pond, extend and maintain an existing 42-inch PSPP stormwater outfall 70-feet along Angelica Creek (CWF), and construct and maintain two temporary road crossings each consisting five, 40.0-foot long, 42-inch pipes in Angelica Creek (CWF), and a pedestrian bridge having a width of 5.0 feet, a normal span of 58.0, feet and an under clearance of 8.0 feet across Angelica Creek (CWF). The project includes the restoration of the riparian buffer along both sides of Angelica Creek (CWF) through planting of various native herbaceous plants, shrubs, and trees. The project is at the former location of Angelica Lake, just west of the new Route 10 bridge, south of the Schuylkill River (Reading, PA Quadrangle, upstream limit: N: 10.8 inches; W: 7.78 inches; Latitude: 40°18'34", Longitude: 75°55'51"; downstream limit: N: 11.10 inches; W: 6.85 inches; Latitude: 40°18'40", Longitude: 75°55'27") in the City of Reading, Berks County.

The issuance of this permit also constitutes approval of a Water Quality Certification under Section 401 of the Federal Water Pollution Control Act [33 U.S.C.A. 1341(a)].

This permit is issued in response to an application filed with DEP on the 18 day of May A.D. 2006, and with the understanding that the work shall be performed in accordance with the maps, plans, profiles and specifications filed with and made a part of the application on the 18th day of May A.D. 2006 subject, however, to the provisions of the Dam Safety and Encroachments Act, the Flood Plain Management Act, The Clean Stearns Law, the Administrative Code, the rules and regulations promulgated thereunder and the following conditions and restrictions. If the work authorized by this permit is not completed on or before the 31st day of December A.D. 2009 this permit, if not previously revoked or specifically extended by DEP in writing, shall become void without further notification.

1. The permittee shall sign the permit thereby expressly certifying the permittee's acceptance of, and agreement to comply with, the terms and conditions of the permit. The permittee shall return a signed copy of the permit to DEP. The permit will not be effective until the signed copy of the permit is received by DEP;
2. DEP, in issuing this permit, has relied on the information and data which the permittee has provided in connection with his permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete or inaccurate, this permit may be modified, suspended, or revoked, in whole or in part, and DEP may, in addition, institute appropriate legal proceedings;
3. This permit does not give any property rights, either in real estate or material, nor any exclusive privileges, nor shall it be construed to grant or confer any right, title, easement, or interest in, to, or over any land belonging to the Commonwealth of Pennsylvania "Commonwealth"; neither does it authorize any injury to private property or invasion of private rights, nor any infringement of federal, state, or local laws or regulations; nor does it obviate the necessity of obtaining federal assent when necessary;
4. The work shall at all times be subject to supervision and inspection by representatives of DEP, and no changes in the maps, plans, profiles, and specifications as approved shall be made except with the written consent of DEP. DEP, however, reserves the right to require such changes or modifications in the maps, plans, profiles, and specifications as may be considered necessary to assure compliance with the Dam Safety and Encroachments Act and other laws administered by DEP, the Pennsylvania Fish Commission and any river basin commission created by interstate compact. DEP further reserves the right to suspend or revoke this permit for failure to comply with a provision of 25 Pa. Code Chapter 105, an administrative order of DEP or a term or condition of this permit;
5. This permit authorizes the construction, operation, maintenance and normal repair of the permitted structures conducted within the original specifications for the water obstruction or encroachment, and in accordance with the regulations of DEP and terms and conditions of this permit. Any repairs or maintenance involving modifications of the water obstruction or encroachment from its original specifications, and any repairs or reconstruction involving a substantial portion of the structure as defined by regulations of DEP shall require the prior written approval and permit of DEP;
6. All construction debris, excavated material, brush, rocks, and refuse incidental to this work shall be removed entirely from the stream channel and placed either on shore above the influence of flood waters, or at such dumping ground as may be approved by DEP;
7. There shall be no unreasonable interference with the free discharge of the river or stream or navigation during construction;
8. DEP reserves the right to take any and all actions regarding the permitted activity that are authorized by law to protect public health, public safety and the environment;

9. The permittee shall notify DEP, in writing, of the proposed time for commencement of work at least 15 days prior to the commencement of construction;
10. If construction work has not been completed within the time specified in the permit and the time limit specified in the permit has not been extended in writing by DEP or if a permit has been revoked for any reason, the permittee shall, at his own expense and in a manner that DEP may prescribe, remove all or any portion of the work as DEP requires and restore the water course and floodplain to their former condition;
11. The permittee shall fully inform the engineer or contractor, responsible for the supervision and conduct of work, of the terms, conditions, restrictions and covenants of this permit. Prior to the commencement of construction, the permittee shall file with DEP in writing, on a form provided by DEP, a statement signed by the permittee and an individual responsible for the supervision or conduct of the construction work acknowledging and accepting the general and special conditions contained in the permit. Unless the acknowledgment and acceptance have been filed, the permit is void. A copy of the permit and the acknowledgment shall be available at the work site for inspection upon request by an officer or agent of DEP or another federal, state, county or municipal agency;
12. The permittee shall operate and maintain the structure or work authorized herein in a safe condition in accordance with the permit terms and conditions and the approved maps, plans, profiles and specifications;
13. This permit may not be transferred without prior written approval from DEP, such approval being considered upon receipt of the properly executed "Application for Transfer of Permit" form;
14. If and when the permittee desires to discontinue use or abandon the activity authorized herein, he must remove all or part of the structure or work authorized and take other actions as are necessary to protect safety and the environment in accordance with a permit issued by DEP;
15. If the use of explosives in any waterways is required, the permittee shall secure the prior written permit from the Pennsylvania Fish and Boat Commission, pursuant to the Pennsylvania Fish and Boat Code, Act 1980-175 Title 30 Pennsylvania Consolidated Statutes, Section 2906. Requests should be directed to the Pennsylvania Fish and Boat Commission, Bureau of Administrative Services, PO Box 67000, Harrisburg, PA 17106; telephone 717-705-7900;
16. Permittee shall implement and monitor the Erosion and Sedimentation Control Plan prepared in accordance with Chapter 102 so as to minimize erosion and prevent excessive sedimentation into the receiving watercourse or body of water;
17. The project site shall at all times be available for inspection by authorized officers and employees of the Pennsylvania Fish and Boat Commission. Prior to commencement and upon completion of the work authorized by this permit, the permittee shall notify the

Pennsylvania Fish and Boat Commission's Southeast Regional Office, Box 8, Elm, PA 17521; telephone 717-626-0228;

18. The project site shall at all times be available for inspection by authorized officers and employees of the Berks County Conservation District. Prior to commencement and upon completion of the work authorized by this permit, the permittee shall notify the Berks County Conservation District, PO Box 520, 1238 County Welfare Road, Leesport, PA 19533; telephone 610-372-4657.

19. **SPECIAL CONDITIONS**

- a. Angelica Creek is managed as a wild trout fishery. No work shall be done in the stream channel between October 1 and December 31 without the prior written approval of the Pennsylvania Fish and Boat Commission's Division of Environmental Services, 450 Robinson Lane, Bellefonte, PA 16823-9620; telephone 814-359-5147.
- b. Permittee shall monitor the wetland replacement site for at least five years. Reports shall be submitted to DEP every six months for the first two years after construction and annually for three years thereafter. The monitoring reports shall contain information describing the success of the site at the time of inspection, an inventory of the surviving plant species and percent aerial coverage, invasive species, photographs of the replacement site with plans showing the location and orientation of each of the photographs, and a written plan to correct any deficiencies identified during the monitoring phase.
- c. Permittee shall monitor the restored stream for at least five years. Reports shall be submitted to DEP every year after construction. The reports shall contain information describing the success of the site at the time of inspection, stability of the banks, photographs of the stream with plans showing location and orientation of the photographs, an inventory of surviving plantings, and a written plan to correct any deficiencies identified during the monitoring.
- d. Permittee shall maintain the structure(s) herein authorized free of flood debris and silt deposits. When removal of silt and debris is necessary, it shall be accomplished in accordance with DEP's "Standards for Channel Cleaning at Bridges and Culverts," a copy of which is attached and made part of this permit.

Future bridge and culvert rehabilitation and maintenance work is subject to the following conditions:

- (1) No reduction of span, underclearance or waterway opening of the structure will occur.
- (2) No roadway grade will be altered, other than that required for normal resurfacing.
- (3) No substantial modification of the structure from its original specifications will be permitted.

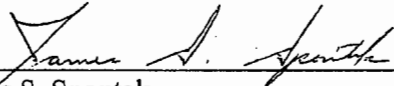
- (4) When work involves repairs to piers, footers or wingwalls, the construction area should be enclosed wherever possible within a cofferdam of sandbags or other nonpollution material.
- (5) The placement of riprap, where necessary, shall not constrict the normal channel width nor shall it interfere with any navigation on the stream or migration of fish.
- e. Temporary stream crossing(s) shall be constructed of suitable non-erodible material in order to prevent any road materials from washing out if structure is overtopped during periods of high water.
- f. The temporary road crossings shall be removed in their entirety upon completion of the project and the channel properly restored and stabilized.

Permittee hereby accepts and agrees to comply with the terms and conditions of this permit.

Permittee (signature)

Date

DEPARTMENT OF ENVIRONMENTAL PROTECTION



James S. Spontak
Program Manager

AUG 18 2006

Issue Date

Permit Application Review Process Fact Sheet
Department of Environmental Protection (DEP)
Southcentral Region

PERMIT PROCESS INFORMATION

Permit Coordination:

Your permit application will be sent to other regulatory programs within DEP for a preliminary review to determine if other permits are required for the activity you are proposing. If it appears other permits are necessary, you will be sent applications for those regulated activities. The coordination of the permit application reviews will be the responsibility of the Assistant Regional Director, Lynn Langer, who can be reached at 717-705-4929.

Administrative Reviews:

Administrative reviews vary slightly by program, but generally include checking for the appropriate signatures, filing fees, notarizations, maps, and application forms. The purpose of the administrative completeness review is to determine whether information and forms are provided. It is not to evaluate the quality or content of the information. Administrative reviews are generally conducted within 20 days of the receipt of the application.

If your application is administratively deficient, we will notify you by phone or letter. You will be given a reasonable time frame in which to submit the required information. If the information is not submitted within that time frame, the application will be returned to you without action by DEP.

When an application is determined to be administratively complete, it will be accepted for technical review by DEP. This means that DEP will initiate the technical review of the application. You will be notified by letter that your application has been accepted. At that time, you will be given the name and phone number of the person to whom your application has been referred for review.

Technical Reviews:

Technical reviews begin once an application is deemed administratively complete and are performed by one or more of DEP's professional staff. The technical review includes an analysis of the proposal for potential adverse environmental impacts; the completeness, clarity and soundness of engineering proposals; conformance with applicable statutes and regulations; and analysis of comments submitted by the public. Please note, applications containing major technical errors will not be reviewed by the agency. Rather, they will be returned with a request that the applicant take more care in preparing the application.

A critical part of the technical review process is the review of comments from the general public and other governmental agencies. Comments may be solicited as a result of publishing a notice of the permit request for draft permit in the *Pennsylvania Bulletin* and newspapers of general circulation, circulating the application to other governmental agencies, or through public meetings or hearings. Unsolicited comments in the form of letters and petitions are also given consideration.

DEP staff will review the application and all other relevant information, and you will be notified by phone or letter if there are deficiencies in your application. You will be given a reasonable period of time in which to address the deficiencies. If you fail to do so within the allotted time, your application will be denied. If the material you submit in response to the deficiency letter still fails to meet DEP's requirements, you will be issued a pre-denial letter. This letter will state that DEP is prepared to deny your application if the ongoing deficiencies are not corrected within a stated time frame. You will have one final opportunity to address those deficiencies; otherwise, the permit will be denied.

When DEP has completed the technical review of your application, a decision will be rendered. If all applicable requirements are met, your permit will be issued. If multiple permits are involved, they will be issued simultaneously from the Assistant Regional Director's office. Permits may be denied for a number of reasons including failure to supply the required information needed for a complete and comprehensive technical review (as described in the paragraph above); failure to show that the activity will not have an adverse impact on the environment; failure to satisfy all applicable legal requirements; or, in some cases, a negative compliance history of the applicant.

If you believe the stated deficiencies in either the deficiency letter or pre-denial letter are not significant, you have the option of declining and asking DEP to make a decision based on the information you have already made available.

Public Input and Participation:

Permit applications may be subject to any or all of the following: notice in the *Pennsylvania Bulletin* or other publication of general circulation; a public meeting; a public hearing. These opportunities for public input are often required by regulation or statute, but may also occur at the discretion of DEP.

Appeal Process:

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa. C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, PO Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

We hope you find this information helpful in understanding the application review process.



Pennsylvania Department of Environmental Protection

909 Elmerton Avenue
Harrisburg, PA 17110-8200
July 20, 2006

Southcentral Regional Office

717-705-4707
FAX - 717-705-4760

Charles M. Jones, P.E.
City of Reading
503 North Sixth Street
Reading, PA 19601

Re: Administrative Complete Letter
Angelica Park/Creek Restoration
Application No. E06-610
Reading City, Berks County

Dear Mr. Jones:

On July 17, 2006, the Department of Environmental Protection (DEP) received the approved Erosion and Sediment Control Plan from the Berks County Conservation District for the Angelica Park restoration project. We have determined that the application now contains the necessary documents and is administratively complete.

The administrative completeness review is the first in a series of reviews conducted by DEP. To help you better understand the application review process, a brief explanation of the permit application review process and approximate times are outlined on the enclosed Permit Application Review Process Fact Sheet.

Your application has been forwarded to the Army Corps of Engineers for review.

I hope you find this information helpful in understanding the application review process. If you have additional questions about your application, please call me at 717-705-4746 and refer to Application No. E06-610.

Sincerely,

Dan Welte
Permitting and Technical Services Section
Watershed Management Program

Enclosure (MBG005)

cc: Mike Campbell, A.D. Marble & Company
Brenda Schrecengost, US Army Corps of Engineers, Philadelphia District Office



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

SEP 12 2006

Regulatory Branch
Application Section I

SUBJECT: CENAP-OP-R-200601059-61 (PASPGP-3)
PADEP #:E06-610

Charles Jones, P.E.
Public Works Director
City of Reading
815 Washington Street
Reading, Pennsylvania 19601-3615

Dear Mr. Jones:

Reference is made to your application to restore the twelve acre drained lake bed adjacent to Angelica Creek, west of the S.R. 10 bridge, at Angelica Lake Park in the City of Reading, Berks County, Pennsylvania.

You are hereby authorized by the U.S. Army Corps of Engineers to conduct the above referenced work under the authority of the enclosed Pennsylvania State Programmatic General Permit (PASPGP-3) (Enclosure 1). Please note that you must conduct the authorized work in accordance with the requirements and conditions of the PASPGP-3 and the following special conditions:

Special Conditions:

1. All work performed in association with the above noted project shall be conducted in accordance with the project plans identified as "Angelica Park Joint Permit Application," sheets 1-13 of 13, dated May 2006, as prepared by A.D. Marble & Company. The project plans provide for approximately 1600 linear feet of stream restoration, 400 linear feet of stream relocation, and creation of a riparian buffer, two 1 acre wetlands, and one 0.5 acre pond. The stream restoration will involve the use of PA Fish and Boat Commission approved trout habitat enhancement structures, including 4 log vanes, 6 rock cross vanes, and 5 root wad structures. The design also includes overflow control structures to allow high flow to be dispersed into the floodplain and the newly-created wetland systems. The existing 42-inch PSPPP stormwater outfall will be extended and two temporary road crossings, each consisting of five 40-foot long 42" pipes, will be installed in Angelica Creek. The stated purpose of the project is to provide for stream and wetland restoration.

2. Any deviation in construction methodology or project design from that shown on the above noted drawings must be approved by

this office, in writing, prior to performance of the work. All modifications to the above noted project plans shall be approved, in writing, by this office. No work shall be performed prior to written approval of this office.

3. This office shall be notified within 10 days of the completion of the authorized work by completing and signing the enclosed "PASPGP-3 PERMIT COMPLIANCE, SELF CERTIFICATION FORM" (Enclosure 2). All notifications required by this condition shall be in writing and shall be transmitted to this office by registered mail. Oral notifications are not acceptable. Similar notification is required each time maintenance work is to be done under the terms of this Corps of Engineers permit.

4. Appropriate erosion and sedimentation control measures must be used and maintained in effective operating condition during construction, and all exposed soil and other fills must be permanently stabilized at the earliest practicable date.

5. The two temporary road crossings shall be removed upon completion of the project, and no later than 30 days from the date of project completion.

If you should have any questions regarding this matter, please contact Brenda R. Schrecengost of this office at (215) 656-5866 between the hours of 1:00 and 3:30 p.m. or write to the above address.

Sincerely,

Frank J. Cianfrani
Chief, Regulatory Branch

Enclosures

Copies Furnished:

PADEP SCRO
Berks Count Conservation District

✓A.D. Marble & Company
375 East Elm Street
Conshohocken, PA 19428

Christopher A. Day (3RC20)
U.S. EPA - Region III
1650 Arch Street
Philadelphia, PA 19103-2029; and

Margaret L. Hutchinson
Assistant United States Attorney
Civil Division Eastern District of Pennsylvania
615 Chestnut Street, Suite 1250
Philadelphia, PA 19106-4476
Re: USAO No. 2003V00437

The transmittal letter forwarding such notice shall include the caption, civil action number and judicial district of this action.

50. Payments to the Commonwealth of Pennsylvania shall be made by tendering to the Pennsylvania Department of Environmental Protection checks made payable to: "Commonwealth of Pennsylvania Clean Water Fund." and sent to Pennsylvania Department of Environmental Protection, 909 Elmerton Ave., Harrisburg, PA 17110-8200, Attn: Lee Yohn, Compliance Specialist.

51. If Defendant fails to tender all or any portion of the civil penalty payment owed to the United States within thirty (30) days of the Date of Entry of this Consent Decree interest on the unpaid amount shall accrue in accordance with the provisions of 28 U.S.C. § 1961 and be paid from the date said payment is due until all amounts owed are paid.

X. SUPPLEMENTAL ENVIRONMENTAL PROJECTS: Angelica Stream Restoration

52. Defendant shall implement Supplemental Environmental Projects ("SEP") in accordance with all provisions set forth in this Consent Decree. The SEPs will consist of the projects as further described in Subparagraphs 52 (a) through 52 (i) below to restore Angelica Creek from Angelica Park to the Schuylkill River, to remove excess sediment, and to create several riparian buffers, functional wetlands and flood plain meadows as well as provide for maintenance. The SEP restoration projects shall be completed within two years of the Entry Date with an additional five years for monitoring and maintenance.

(a) **Background:** Prior to 2001, Angelica Creek meandered through Angelica Park located in the City of Reading, and emptied into Angelica Lake where it was contained by a dam at Route 10. The Lake and Creek were used frequently by the community for recreational purposes for fishing and boating. Both the Lake and Creek are designated as trout stocking waters and supported a diverse aquatic community including trout. In 2001 the Dam was breached and the lake was emptied leaving behind a great deal of sediment and impaired aquatic life conditions. Since that time, the stream has begun forming a natural meandering channel through the lake bed sediments and continues on beneath the newly built bridge at Route 10. The stream through that is heavily degraded and down cutting the lake bed sediment layer due to a lack of vegetation and bank stabilization. A large amount of sediment is being deposited into the stream and contributing to high sediment loads entering the Schuylkill River. The City of Reading has decided not to rebuild the dam.

(b) **Goals of SEPs:** The goals of these SEPs are to restore the recreational and aquatic life uses of Angelica Creek from Angelica Park to the Schuylkill River by removing excess lake bed sediment, restoring the Creek, creating two wetlands and a flowering meadow flood plain. These SEPs are intended to restore the recreational and aquatic life uses of Angelica Creek, they will also substantially reduce the sediment load to the Schuylkill River. These SEPs are consistent with and will further achieving the goals of the Clean Water Act. In addition to the SEPs described below, the City of Reading is also planning to make a number of enhancements to the park including a pedestrian bridge, park benches, and signage to provide information about the Creek, the SEPs and the surrounding ecosystems.

(c) **Removal of excess sediment and soil stabilization SEP:** Within fifteen (15) months of the Entry Date, the Defendant shall remove excess sediments from the Areas marked on the Map attached to this Decree as Exhibit A and stabilize existing soils as necessary to complete the other projects described below. As part of the SEP final plan submission described in Subsection 52 (i) below, Defendant shall identify among other items information on the depth

of sediment and area for this project sufficient to calculate the cubic yards of sediment to be removed from the Area. Defendant estimates expenditure for this SEP at \$300,000.

(d) **Angelica Creek Restoration SEP:** Within two years of the Entry Date, Defendant shall complete approximately 1600 linear feet (LF) of stream restoration from the pedestrian bridge in Angelica Park to the Route 10 bridge underpass as indicated on the Exhibit A to the Decree. Defendant shall also restore an additional 400 LF of degraded stream restoration below the Route 10 Bridge to the Schuylkill River. The Stream banks will be graded, stabilized with rock protection and multiple bio-engineering techniques such as erosion control matting and appropriate stream bank plantings. In order to control the flow of stream, multiple structures including constructed riffles, rock deflectors and root wads will be placed along the length of the stream. These structures will contribute to the stabilization of the stream channel reducing the possibility of sediment erosion as well as increase aquatic habitat. As part of the SEP final plan submission described in Subsection 52 (i) below, Defendant shall identify among other items the specific plant species to be used, the density of plantings and where the plants will be used. Defendant shall not spend less than \$93,000 for this SEP.

(e) **Angelica Creek Riparian Buffer SEP:** Within two years of the Entry Date, Defendant shall complete a minimum one hundred foot (100') riparian buffer strip for Angelica Creek (with at least fifty feet of riparian buffer on each side of the Creek) from the pedestrian bridge in Angelica Park to the Route 10 underpass. This SEP will filter runoff, slowing flow of storm water, reducing erosion and will provide shade coverage for the stream channel. As part of the SEP final plan submission described in Subsection 52 (i) below, Defendant shall identify among other items the specific plant species to be used, the density of plantings and where the plants will be used. Defendant shall not spend less than \$54,000 on this SEP.

(f) **Wetland Creation SEP:** Within two years from the Entry Date, Defendant shall complete construction and planting for two wetlands adjacent to Angelica Creek in the approximate locations as indicated on Exhibit A to this Decree. Each wetland shall be

approximately 1 acre in size. These two wetlands will provide relief for the stream during storm events, reduce erosion and contribute to treatment of water quality. To enhance the contribution of this SEP to aquatic and wildlife uses, each wetland will provide several types of wetland habitat and will include wildlife structures such as brush piles and deadfall snags. As part of the SEP final plan submission described in Subsection 52 (i) below, Defendant shall identify among other items details of the elevations and area of the proposed wetland, the specific plant species to be used, the density of plantings and where the plants will be used. Defendant shall not spend less than \$69,000 on this SEP.

(g) **Flood plain Meadow SEP:** Within two years of the Entry Date, Defendant shall create approximately three (3) acres of flood plain meadow in the general areas adjacent to the wetlands and Angelica Creek as indicated on Exhibit A to the this Decree. Design and construction of these meadows shall be incorporated into the design and creation of the wetlands described above in Subparagraph (f). These meadows will contribute to relief for the stream during storm events, reduce erosion as well as increase the diversity of wildlife habitat and contribute to park aesthetics. As part of the SEP final plan submission described in Subsection 52 (i) below, Defendant shall identify among other items the specific plant species to be used, the density of plantings and where the plants will be used. Defendant shall not spend less than \$10,000 on this SEP.

(h) **Annual Maintenance and Access to SEPs:** Defendant shall provide adequate maintenance including replacement of necessary plantings for the SEPs discussed above in Subparagraphs 52 (d) through 52 (g) for no less than five years after EPA approves the completion of each SEP. In order to provide adequate maintenance for the SEPs described above, reduce the threat of invasive species and to facilitate public access to the Angelica Creek, Defendant shall also construct a crushed stone walking trail and adequate landscaping to reduce erosion from that trail and public access. Defendant is encouraged to connect this trail with existing Park trails. Defendant shall spend not less than \$32,000 in construction costs for the

trail and associated landscaping. As part of the SEP final plan submission described in Subsection 52 (i) below, Defendant shall identify among other items the specific plant species to be used, the density of plantings and where the plants will be used, and how the associated landscaping and maintenance will prevent the introduction and spread of invasive species. Defendant shall spend no less than \$5,000 per year for each year of maintenance of the SEPs identified above in Subparagraphs 52 (d) through 52 (g).

(i) Design Costs and Final Plan

Defendant shall provide adequate design and obtain necessary permits and approval for each of the SEPs described above. Defendant estimates that design costs will be no less than \$150,000. Within seven (7) months of the Entry Date, Defendant shall submit a final plan to EPA and PADEP for review. This final plan shall include the details of design and completion for each SEP as discussed above in Subparagraphs 52 (c) through 52 (g). Upon approval by EPA in accordance with Paragraph 43 of this Decree, Defendant shall then proceed to implement each SEP according to the schedule contained in each Subparagraph of this Decree.

(j) Defendant Certification: With regard to the SEPs, Defendant certifies the truth and accuracy of each of the following:

1. That all cost information provided to EPA and PADEP in connection with EPA's approval of the SEP is complete and accurate and represents a fair estimate of the costs necessary to implement the SEP;
2. That, as of the date of lodging of this Decree, Defendant is not required to perform or develop the SEP by any federal, Commonwealth, or local law or regulation, or as injunctive relief awarded in any other action in any forum;
3. That Defendant has not received, and is not negotiating to receive, credit for the SEP in any other enforcement action; and
4. That Defendant will not receive any reimbursement for any portion of the SEP from any other person.

(k) SEP Completion Report

1. Within 90 days after the date set for completion of each SEP described above in subparagraphs 52 (c) through 52 (g), Defendant shall submit a SEP Completion Report to EPA and PADEP. If appropriate, the Report may combine information on the completion of more than one SEP. The SEP Completion Report shall contain the following information:

- a) A detailed description of the SEP as implemented;
- b) A description of any problems encountered in completing the SEP and the solutions thereto;
- c) An itemized list of all eligible SEP costs;
- d) Certification that the SEP has been fully implemented pursuant to the provisions of this Decree; and
- e) A description of the environmental and public benefits resulting from implementation of the SEP (with a quantification of the benefits and pollutant reductions, if feasible).

2. EPA may, in its sole discretion, require information in addition to that described in the preceding Paragraph, in order to determine the adequacy of SEP completion or eligibility of SEP costs.

3. After receiving the SEP Completion Report, EPA shall notify Defendant whether or not Defendant has satisfactorily completed the SEP. If the SEP has not been satisfactorily completed in accordance with all schedules, or if the amount expended on performance of each SEP is less than the 90% of amount set forth above, stipulated penalties may be assessed in accordance with Paragraph 55 of this Consent Decree.

4. Disputes concerning the satisfactory performance of the SEP and the amount of eligible SEP costs may be resolved under Section XIII of this Decree (Dispute Resolution). No other disputes arising under this Section shall be subject to Dispute Resolution.

5. Each submission required under this Section shall be signed by an